Identifying And Managing Risks During Decommissioning Of José Cabrera NPP – 14649

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ABSTRACT

The dismantling of José Cabrera NPP (Zorita) is an ambitious project, which aims to completely disassemble the plant and release the site on a very tight timeframe.
It involves performing complex activities, such as the segmentation of all primary circuit components, including reactor internals and the vessel.

Three and a half years after the project started (in 2010), a significant portion of the components of the plant have been removed, and their waste properly managed, those including the reactor internals, the cooling pump, the pressurizer and 50% of the steam generator.
The experience gained so far in this project confirms that not all activities can be implemented in the way they were designed or scheduled. Therefore, it is important to early detect potential difficulties affecting the program progress and trying to mitigate their effects, identifying and programming the appropriate compensating measures.

The first part of this document provides information about project activities to date, while the second part identifies the principal risks affecting the project and the steps taken to mitigate their impact.

INTRODUCTION

Enresa is responsible for managing all radioactive waste produced in Spain and for dismantling its nuclear facilities. In accordance with this mission, in February 2010 the dismantling and decommissioning of the "Jose Cabrera" nuclear power plant began (Almonacid de Zorita, Guadalajara, Spain, also known as the Zorita plant), the first nuclear power plant to begin operating in the country in 1968. The plan is that in 2017 the land occupied by the plant will once again look as it did originally prior to construction of the installation.

PROJECT SCOPE & PROGRESS

During the operations phase, the installation consisted of a pressurized light water reactor (PWR), a turbine-generator set with 160 Mwe electrical power, and all the necessary safety and auxiliary systems.

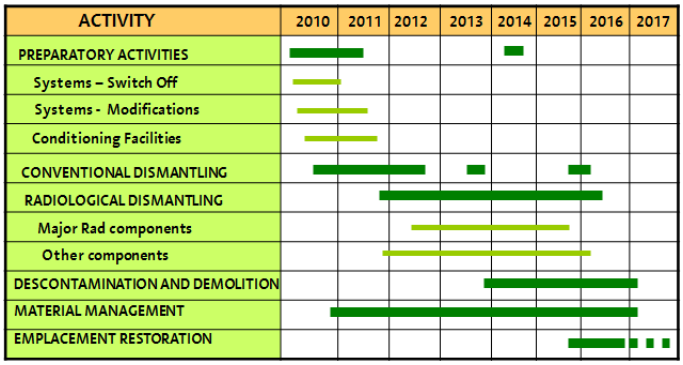

Fig. 1.Dismantling project schedule.

Fig. 2. José Cabrera NPP General View.

What makes this dismantling project different from others conducted in Spain (Vandellós I) is undoubtedly segmenting the reactor vessel and its internal components, as well as directly conditioning the materials produced in Storage Units ($8m^3$ containers used up to now only in the El Cabril storage centre). To implement it, it has been necessary to first undertake major refurbishment work of the existing installations, especially in the former turbine building and in the containment building.

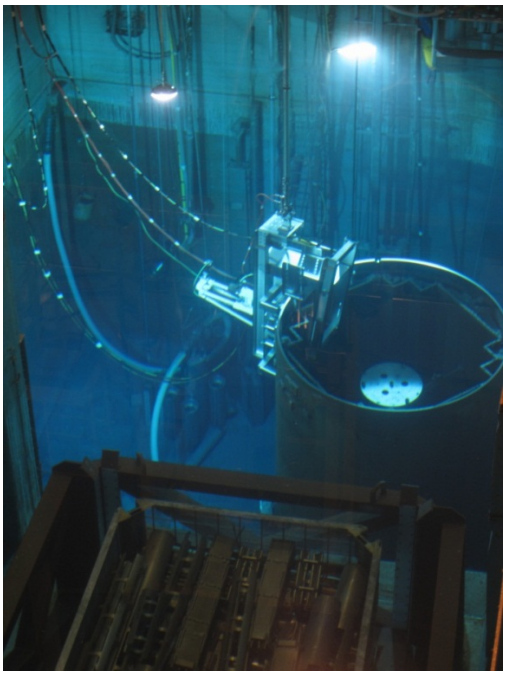

Fig. 3. Segmentation of the reactor lower internals under water.

The internal components were cut under water using robotic tools, as was the case with the vessel.

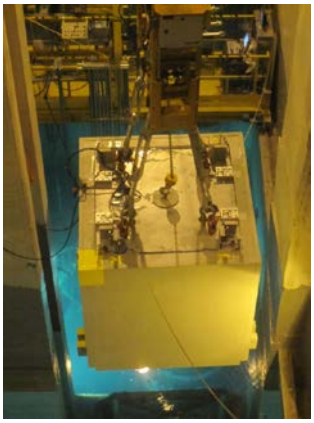

Fig. 4. Removing waste from the reactor for conditioning.

Subsequently, the baskets with the least active parts were removed from the cavity, properly shielded, and transported to the former turbine building, where they were inserted in concrete containers, conditioned and held to await transfer to the very low, low and medium activity waste storage centre that Enresa operates at El Cabril (Cordoba, southern Spain).

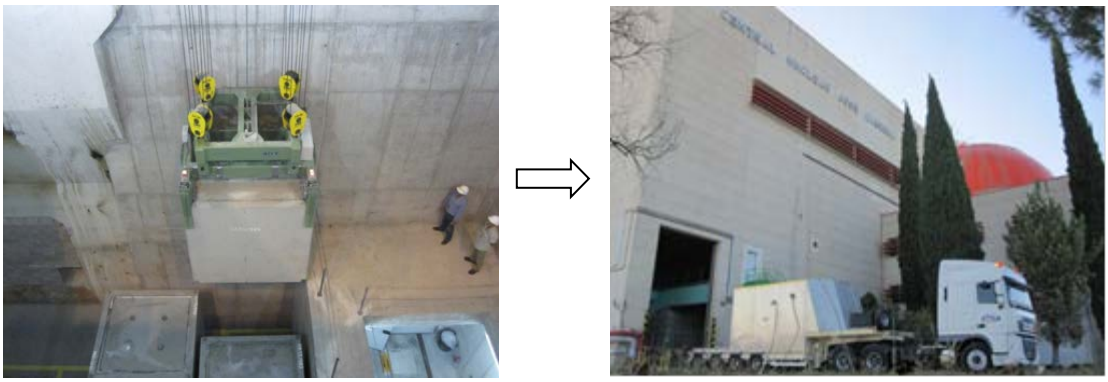

Fig. 5.The waste is packaged in concrete containers for shipment to El Cabril.

In addition, the parts closest to the reactor core, with activity levels that do not enable storage at El Cabril, are stored in 4 HI-SAFE model special containers, manufactured from carbon steel and high density concrete.

This waste will be kept in the Individual Temporary Storage (ITS) at Zorita together with the 12 containers that store spent fuel from the plant.

Fig. 6. Special waste load containing the reactor internals.

Fig. 7. Transport of HI-SAFE container to ITS.

After segmenting and conditioning the Zorita reactor internals, the reactor vessel itself is cut and conditioned, and the other primary circuit components are removed, work currently in progress.

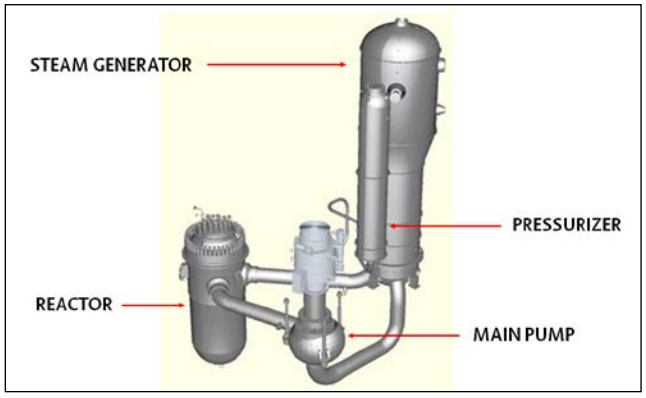

Fig. 8. José Cabrera NPP Primary circuit.

Fig. 9.Removing the primary circuit Main Pump.

Fig.10.Cutting one of the pieces dismantled from the Pressurizer

Fig. 11. Steam Generator Segmentation.

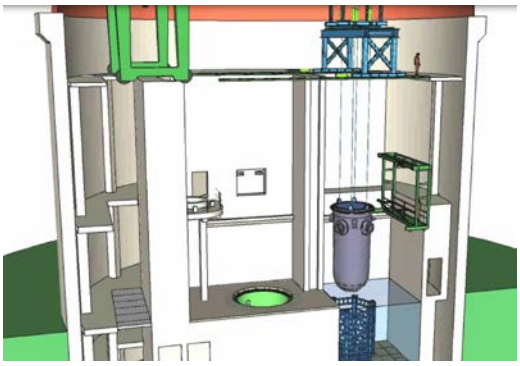

Fig. 12. Engineering plan for segmenting the reactor vessel.

Once the buildings are completely empty, and after determining that both the walls and floors are free from contamination, conventional demolition will begin. Using the resulting debris, processed in situ, holes discovered in the foundation will be filled in, which will enable a restoration plan to be implemented leaving the land in the same condition as it was in the early 60s of the last century, the period when the installation was built. That will be the time when this project, budgeted in 2003 with an expenditure of 135 million euros, will be complete.

RISK IDENTIFICATION AND MANAGEMENT DURING DISMANTLING

Dismantling a nuclear power plant such as Zorita involves a number of risks and uncertainties that could compromise correct execution of the project. For this reason, it is necessary to employ a system of working that enables them to be identified at the earliest opportunity so that they can be managed in a timely fashion.

Constantly monitoring the work schedule and carrying out detailed analysis of interfaces and uncertainties associated with each task involved, have been the main practices employed to identify actual and potential risks and opportunities that could affect the project at any time. Consequently, risk management has not been focused on as a specific activity, but has been an integral part of every meeting held by the multidisciplinary project team.

Therefore, rather than present our specific experience in the application of risk management methodologies, the next few paragraphs itemise some of the situations that have changed or could have

changed the duration, budget, quality or safety conditions when dismantling the José Cabrera NPP, in the hope that the information will be useful for other dismantling projects. They are grouped around the following themes:

1. Project design.
2. Relationships with the Regulatory Authority.
3. Contracting.
4. Waste Management.
5. Project Tracking.
6. Communications and Relationships with the Outside.

Project Design.

The project design phase is basic to all dismantling. The more thorough and complete the documentation prepared, the better the actual conditions at the plant and its operating history are researched, the fewer risks and uncertainties will arise during the implementation phase.

In the case of Zorita, the preparatory work prior to the start of dismantling provided sufficient detail about the plant and its condition at the time of its transfer to Enresa. However, during the work there were setbacks resulting from a lack of knowledge about the actual state of the plant, in particular regarding the following:

- The actual radioactive waste inventory remaining at the plant, from the operations stage.
- The conservation status of some systems needed for dismantling.
- Incidents occurring during the operations phase.
- Non-standard infrastructure and equipment.
- Undocumented presence of toxic and/or hazardous products (asbestos).

In general, these occurrences required actions not initially planned as part of the work schedule, producing occasional overruns and delays in the early stages of the project.

Fig. 13. Asbestos works.

Fig. 14. Asbestos works.

Relationships With The Regulatory Authorities

The decommissioning of Jose Cabrera NPP required an ongoing dialogue between the operator responsible and the regulatory authorities for various reasons, particularly the numerous partial authorizations required from them throughout the project. The authorizations required from the regulator included the following:

- Implementing new systems required for dismantling
- Design modifications to old systems
- Material declassification methodologies and release of buildings and land.

Achieving the work schedule depends largely therefore on these authorizations being granted at the right time and with conditions consistent with those already provided for in the authorization obtained at the start of the dismantling project as a whole.

The dismantling experience at the Jose Cabrera NPP shows that:

- Sometimes, especially at the beginning of the project, the time allowances built into the work schedule for the regulatory authorities to issue their authorizations were unrealistic, and were shorter than those actually required.

- As a corrective measure, in addition to adjusting the schedules to accommodate the actual time required, prior contacts with the regulatory authority were intensified, in order to make them aware in previous conceptual meetings and presentations, of the content of documents and proposals to be authorized. These meetings proved to be very effective, greatly facilitating the licensing processes.

- The regulations applicable to ventilation systems at the time the project authorisation were obtained were less stringent than those applying at the time the changes were made, several months later. This resulted in very substantial changes to both the type of equipment to be installed, which had already been contracted, and the applicable test protocols, leading to overruns and delays in implementing these systems.

  As a result, it was found that unstable regulations or regulations which change over time, are a risk relevant to dismantling projects, which are usually very long-term projects.

Fig. 15. EAD Ventilation Equipment (Testing).

Fig. 16. EAD Ventilation Equipment (Testing).

Contracting

The strategy adopted for contracting work, goods and services, and the management of the corresponding contracts, is a key aspect of project management.

The policy adopted in dismantling Zorita has been to divide the work into many contracts, always incorporating the latest information available and with well-defined scopes and deadlines. The opposite option, namely to adopt only one or several large "turnkey" contracts is judged to be very risky because of the impossibility of defining the scopes in detail, and the difficulty of incorporating the contingencies that are inevitably required for this type of work.

After the contracts have been established, it is important that they contain clauses enabling contractors to be penalised, incentivised or redirected, so that the person responsible for the work does not lose control over it.

Some of the types of problems encountered during the work were as follows:

- Difficulty experienced by some contractors in performing the detailed engineering required.
- The boundaries between the work carried out by different contractors may be blurred (Example: in-situ decontamination of components versus workshop decontamination, dismantling of systems and decontamination of surfaces, by different contractors.)
- Difficulty in redirecting a contractor, due to the lack of penalty/termination clauses for interim deadline defaults.
- The timescale of some of the service provision contracts was shorter than that of the project as a whole, which resulted in the replacement of staff fully adapted to the functioning of the work by others completely unfamiliar with it, with a consequent impact on the normal operation of the organization.
- The lack, in some cases, of mechanisms to incorporate additional work (contingencies) within the scope of the contracts.

Waste Management

The waste generated by the dismantling has to be managed with an eye to the acceptance criteria in force at the storage and/or treatment centres.

It is important to be familiar with all the flows of material to be managed and to ensure that they are all properly documented and authorized, so that waste can be dispatched from the site as soon as possible.

During the Zorita dismantling, various material flows were not initially foreseen in the project waste management plan (historical waste from operations not inventoried), which caused additional workloads and cost overruns.

On the positive side, the opportunity arose to channel some waste through different channels, more advantageous than initially contemplated. So, the purification equipment filters for the water from the cavities where the segmentation was conducted have in the end been managed using the same types of concrete containers used for the reactor internals, instead of drums, avoiding numerous manual actions (slicing) and resulting in reducing costs, time and the radiological impact on workers.

In this regard, it should be noted that the agility to open new channels is helped by the fact that Enresa is the company responsible for dismantling nuclear installations, and radioactive waste storage, and therefore defining waste acceptance criteria.

Fig. 17. Filters Testing.

Fig. 18. Waste Basket with filters.

Project Tracking

An ongoing and rigorous analysis of the work programme is essential for managing project risks. Providing timely and complete information on each of the activities, analyzing potential problems in implementing them, and taking compensatory measures if such problems arise, are essential to mitigate the consequences of unforeseen events.

One example has been the contingency plan established for possible breaks in the liner of the Spent Fuel Pit during segmentation of the reactor internals. Early implementation of a water recirculation system helped solve two incidents in which large pieces of metal collided with and pierced the liner, causing leakage of water from the cavities.

This very thorough analysis of the programme led to the segmentation activities on the pressurizer and recirculation pump being advanced by at least twelve months, activities which were initially scheduled to follow completion of the internals segmentation. In an "express" operation, initially not contemplated to take place at that time, before cutting up the internals, the primary circuit was drained and the hot and cold branches isolated, enabling the large component dismantling schedule to be significantly advanced.

Unlike construction work in which the sequence of actions must necessarily follow a predefined path, dismantling enables a certain degree of freedom and numerous parallel activities to be managed. A good work monitoring program is key to unlocking the opportunities presented.

Fig. 18. Daily Project Meeting. Fig. 19.

Fig. 19. Liner damage.

Fig. 20. Primary Circuit Isolation.

Communications And Relationships With The Outside

A major risk to the project is the lack of acceptance by its stakeholders (local and regional institutions, associations, general public).

It is necessary therefore, to apply various complementary policies with regard to education, supporting the local economy and especially, communication.

In this respect, during dismantling the José Cabrera NPP, regular meetings were held with the media and institutions, and an information centre was established that receives numerous visits every year from students, professionals and the dismantling stakeholders. Similarly, all significant tasks are tracked by chart and the materials produced published (videos, photos) on the Enresa website (www.enresa.es).

Fig. 20. Information Center.

Fig. 21. Press Conference.

CONCLUSIONS

Dismantling the Jose Cabrera NPP is a complex industrial process and as such, has its risks. Their preventive identification, with the collaboration of the entire organization, has been demonstrated as essential for ensuring the proper conduct of the work.

Familiarity with the operating history of the plant, using as complete a project as possible, establishing a relationship of mutual trust with the regulator, contracting the different services correctly, the availability of management channels for all the waste, daily project supervision and communicating developments, are essential to minimize risks and better achieve the objectives.