Radioactive Waste Management & Decommissioning

The Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management was signed by Spain and entered into force on June 2001. Apart from addressing the fuel and radioactive waste from defense programs, the Convention applies to spent fuel and radioactive waste resulting from nuclear reactors operations and dismantling, and applies to planned and controlled releases into the environment of liquid or gaseous radioactive materials from regulated nuclear facilities.

The obligations of the Contracting Parties are fundamentally based on the principles established in the IAEA Safety Fundamentals document "The Principles of Radioactive Waste Management", published in 1995, which include the obligation to establish and maintain a legislative and regulatory framework to govern the safety of spent fuel and radioactive waste management, and the obligation to ensure that individuals, society and the environment are adequately protected against radiological and other hazards, by ensuring the safety of facilities along their lives, also addressing the trans-boundary movement of spent fuel and the safe management of disused sealed sources.

Endesa is committed to the safety in all stages of radioactive waste and spent fuel management undertaken on site, encouraging the application of effective measures to protect the workers, the public and the environment form any risk or harmful effect from ionizing radiation, considering both present and future generations.

Endesa encourages proper control of generation and flow of radioactive materials, addressing the following objectives:

- Minimizing the amount of waste generated
- Recovering of waste materials
- Guaranteeing the interdependence of all phases of management

All this is done in such a way that safety and radioprotection principles are met in the transfer to other stages of management and keeping environmental impact to the minimum practicable level.
• **Legal framework:**

The following national and international regulations establish the pattern for nuclear waste management in Spanish NPPs:

- Ley 25/1964, de 29 de abril, sobre energía nuclear, where the bases for the nuclear development in Spain are established.
- Real Decreto 1522/1984, de 4 de julio, por el que se autoriza la constitución de la «Empresa Nacional de Residuos Radiactivos, S. A.» (ENRESA).
- Real Decreto 1836/1999, de 3 de diciembre, por el que se aprueba el Reglamento sobre instalaciones nucleares y radiactivas, further modified by RD 35/2008
- Real Decreto 1349/2003, de 31 de octubre, sobre ordenación de las actividades de la Empresa Nacional de Residuos Radiactivos, S. A. (ENRESA), y su financiación.
- Real Decreto-ley 5/2005, de 11 de marzo, de reformas urgentes para el impulso a la productividad y para la mejora de la contratación pública, that modifies the ENRESA financial system
- Ley 24/2005, de 18 de noviembre, de reformas para el impulso a la productividad, where the role of ENRESA in the management of the radioactive waste, including the spent fuel and the dismantling and closure of nuclear power plants and other radioactive installations, is confirmed
- Ley 11/2009, de 26 de octubre, por la que se regulan las Sociedades Anónimas Cotizadas de Inversión en el Mercado Inmobiliario, where the tax values for the financing of the PGRR funds are established.
- Real Decreto 102/2014, de 21 de febrero, para la gestión responsable y segura del combustible nuclear gastado y los residuos radiactivos.

• **Waste Management System**

In Spain the final management of low, intermediate and high activity radwaste, as well as decommissioning of nuclear installations is, by law, a responsibility of the Spanish State. For this purpose, the State has created a 100% State owned company ENRESA, that is responsible for these activities. ENRESA objectives are defined in the General Plan for Radioactive Waste Management (PGRR). The PGRR is an official document prepared by ENRESA, approved by the Ministry of Industry, Tourism and Trade (MITT), and presented to the Parliament. This document is periodically reviewed taking into account the new scenarios and the technological improvements related to this topic. In addition, financial aspects are considered...
To implement the PGRR in 1989 an agreement between ENRESA and the utilities was undertaken and approved by the Ministry of Industry. This agreement, which is reflected in the “Standard Contract”, specifies the scope of services to be provided by ENRESA to manage radioactive waste, spent fuel & decommissioning of Spanish NPP and the responsibilities of each party. A specific contract in signed between ENRESA and each of the NPP.

Services provided by ENRESA under these contracts cover the following:

- ENRESA defines the criteria for waste characterization and conditioning previous to the evacuation from the site and promotes, jointly with each NPP, the actions for waste volume reduction or waste clearance, aiming these actions should help to optimize the utilization of El Cabril, the centralized facility for storage of medium, low and very low activity waste.
- ENRESA is in charge of defining the conditions for Dismantling and Decommissioning operations. License holders take part in these plans for decommissioning and dismantling of their facilities. Appendix J of the Standard Contract establishes the responsibilities in this regard and provides the reference schedule for transferring the facility from the owner to ENRESA.

Each NPP has in place a plant specific “Radioactive Waste Management Plan” (RWMP). This document defines the framework for waste and spent fuel management during the entire plant lifetime, including the decommissioning phase.

The Plan addresses the production, handling, treatment, conditioning, temporary storage and, when applicable, the provisions for future steps management. An updated inventory of the waste generated (volume or weight) from different plant systems is kept updated and the management standards for the aforementioned operations is properly defined. Minimization of radwaste volumes and protection of the health and safety of plant workers, public, and environment from harmful effects in every stage of the plant lifetime are the main goals pursued by the Plan.

Royal Decree 5/2005, regarding the financing system of ENRESA, establishes that the Spanish NPPs were responsible for funding all activities related to waste management, spent fuel and decommissioning of Spanish NPPs from April 1, 2005. This financing provision must cover until the year 2080. Past this date, further long-term liabilities correspond to the State. The total resources expected to be used in the current PGRR are 13.000 million of €. The distribution of these resources is the following:

- Low and intermediate radwaste management 12%
- Spent fuel and high radwaste management 45%
- Nuclear installation decommissioning 26%
- ENRESA structure and other costs 17%
For this purpose a specific tax, payable by the utilities owner of the NPP, has been created. This tax applies to the energy produced in each NPP and is different for each type of reactor. It is paid on a monthly base.

**Low and intermediate radwaste management**

In the ENRESA-Utilities Standard Contract mentioned above, there is a specific annex related to this type of radwaste. In this annex, the responsibilities and activities of each part are defined.

The NPP characterizes and conditions the radwaste in solid form in standardized receptacles, usually 220 liter drums, according to the requirements defined by ENRESA: The resulting filled drums are stored in the temporary storage facility inside the NPP site. These are specifically designed warehouses, radiologically controlled, where the conditioned drums are classified and prepared for their expenditure to the national repository. While being stored, the responsibility for this radioactive material is of the NPP.

As stated in the ENRESA-Utilities agreement, conditioned waste is transported on a regular basis to the national repository for medium and low level waste located in “El Cabril” (Cordoba), at the south of Spain. The transportation is made by conditioned trucks belonging to an authorized company for this kind of transports and is responsibility of ENRESA. This strategy prevents waste from building up in the site, facilitating future decommissioning activities and reducing the amount of wastes to be dealt with during that phase of the plant life.

Radwaste minimization is also addressed by the plant strategic business plan, where specific challenging targets based on best industry practices are set up. Targets are revised periodically, and action plans for achieving the goals are consequently defined and implemented.

According to the RWMP, diverse radwaste minimization techniques are used to minimize the radioactive waste volume during the entire lifecycle of the facility, including the decommissioning phase. Waste streams are classified according the origin, nature, radioactivity, physical & chemical characteristics, hazard, and the management route defined for each waste stream.

Clearance of waste materials, to enable processing them through conventional routes, is also carried out in application of several clearance projects developed in the framework of UNESA.

Use of state of the art equipment, in-situ waste segregation, material reuse, recycling, and decontamination are also addressed by the RWMP to minimize radwaste volumes.

Accordingly, work activities are planned and conducted to minimize radwaste generation.
Spent fuel and high radwaste management

In the ENRESA-Utilities Standard Contract mentioned above, there is also specific annex related to this type of radwaste. In this annex, the responsibilities and activities of each part are defined.

Initially spent fuel and other high activity wastes are stored under water in the spent fuel pool. This is a specially designed pool of borated water that is in the spent fuel building in the Westinghouse design and inside the containment in the KWU design. Inside the pool there are metallic racks where the fuel rods extracted from the reactor core and canisters that hold the other high activity waste are inserted. The mission of the water in both extraction of the residual heat from the spent fuel and the shielding for the radiation generated by the disintegration of the fission products. All the building is considered radioactive area with special surveillance and filtered ventilation.

For further management of the spent fuel, Spain has decided the option of “open cycle”, that is with no reprocessing. Thus, after cooling and decaying in the spent fuel pool, the spent fuel rods are to be handed over to ENRESA for their custody and safe storage. For this purpose, in the PGRR ENRESA plans an intermediate centralized installation (ATC) capable to store all the spent fuel rod of all the Spanish NPP and a deep geological installation (AGP) for final disposal of the high activity waste.

In the PGRR the ATC installations was scheduled to be ready in 2018. From there on spent fuel rods in the NPP spent fuel pools were to be transferred to dry storage casks in the site and transported to the ATC. This will free storage positions for new spent fuel rods. Nevertheless, the ATC has been delayed, mainly due to administrative problems associated with the public acceptance of this type of installations. The new date for the ATC is 2024.

Due to this delay and to optimize the logistics of the transportation of the spent fuel casks from the NPP to the ATC, specific dry storage areas within the NPP sites (ATI) are also planned. Ascó and Trillo NPP already have their ATI in operation and Almaraz and Vandellós II NPP are in the project phase.

Thus, the current procedure is that spent fuel rods is initially stored under water in the spent fuel pool, until the thermal and radioactive characteristics of the spent fuel allow its dry storage in spent fuel casks. The spent fuel rods are then introduced in the casks and taken to the on-site ATI. Later, when the ATC will be ready (from 2024 onwards) these casks will be transported to the ATC site and the spent fuel rod will be lodged in the cells designed for this purpose. Casks can then be reutilized to transport new spent fuel rod.

All this processes are subject to the safety regulations and in addition to internal self-assessments, periodic evaluations by the regulatory body, audits, and evaluations by independent nuclear oversight organizations are undertaken. The radwaste management process is also evaluated by WANO every four years, comparing the plant
practices against the best industry standards. Weaknesses are reported into the CAP to improve the process (continuous improvement model).

**Nuclear installation decommissioning**

In the ENRESA-Utilities Standard Contract mentioned above, there is also specific annex related to nuclear installations decommission. In this annex, the responsibilities and activities of each part are well defined.

The established scheme is that the NPP is that after definitive shut down of the NPP, it is responsible of managing and handing over to ENRESA all the low and intermediate operational and structural radwaste produced in the operation period and still stored in the site. The NPP is also responsible from emptying the spent fuel pool of all the spent fuel and high activity radwaste produced in the operation period. This kind of waste does not need to me removed from the NPP site, but it should be conditioned in spent fuel casks ready to be eventually transported to the ENRESA installations (ATC or AGP).

After these conditions are met, ENRESA will take over the responsibility of the installation and will undertake all the dismantling activities to take it over to a “green field” condition. The site will be then returned to the initial owner.

The current projects for these operations are 3 years to condition the low and intermediate operational and structural radwaste and the spent fuel, and 7 years for the dismantling process.

By the Spanish legislation, the dismantling project is subject to an environmental evaluation by ENRESA, which includes public participation and is approved by the Government. As a result of the evaluation, corrective and preventive measures may be implemented to minimize the impact of these activities.