

## **RADIOACTIVE WASTE MANAGEMENT PROGRAMMES IN OECD/NEA MEMBER COUNTRIES**

### **SPAIN [2018]**

#### **NATIONAL NUCLEAR ENERGY CONTEXT**

Commercial utilization of nuclear power for electricity production in Spain started in 1968. By the end of 2017 there were 7 nuclear reactors in operation that generated 58.1 TWh, roughly 20% of the total electricity production that year. In the same date, three more NPPs with a total output of 1,160 MWe had been shut-down and were at different levels of decommissioning.

Use of radioisotopes for different applications out of the nuclear fuel cycle is widespread totalling more 1,000 licensees of which roughly 800 generate radioactive waste on a regular basis.

Presently, the only steps of the nuclear fuel cycle carried out in Spain are the fabrication of nuclear fuel, the generation of electricity and radioactive waste management.

Nuclear fuel fabrication is around 400 tHM/year for light water reactors at a plant in Juzbado (Salamanca province).

Uranium mining was over by the turn of the century and uranium enrichment is carried out abroad.

There is neither a reprocessing policy nor reprocessing facilities in the country. The only SF reprocessed to date has been that generated by Vandellós I NPP, and certain amounts sent to Great Britain from the José Cabrera and Santa María de Garoña NPPs before 1983.

Spent fuel is stored at the nuclear power stations where it arises (either within the pools or in dry interim storage facilities). Very low level waste (VLLW) and low and intermediate level waste (LILW) generated in nuclear and other facilities, including waste arising from decommissioning, are disposed of in a near-surface repository in the province of Córdoba. Spain is a signatory of the NPT and there is not a nuclear weapons program in Spain.

Nuclear energy policy has been unchanged during the last years. In addition, there are no plans for new nuclear build.

#### **SOURCES, TYPES AND QUANTITIES OF WASTE**

Radioactive waste has been generated in Spain since the 1950s. The waste arises from the existing 7 commercial reactors at the NPPs Almaraz, Cofrentes, Trillo, Vandellós-2 and Ascó, the nuclear fuel manufacturing plant and from the more than one thousand institutional producers using radioisotopes for industrial, medical and research purposes. A further significant source of waste is the dismantling of the three reactors that were shutdown: Vandellós 1 in 1990, José Cabrera in 2006 and Santa María de Garoña in 2017. In the future the activities involved in the decommissioning of the NPPs will be the largest source of waste production.

Radioactive waste (RW) in Spain is classified according to the facilities where is to be disposed of; those authorised for a certain volume, radiological inventory and certain limits regarding specific activity concentrations based on the nature of the different radioactive

elements in the waste. Actually, the different categories match the radioactive waste classification criteria adopted by the International Atomic Energy Agency (IAEA) and the European Commission: Low and Intermediate level waste (LILW), Very Low Level waste (VLLW), which is considered a sub-group of low and intermediate level waste, Special Waste (SW) and High Level Waste (HLW). Spent Fuel (SF) is included in this latter category as there is no further use foreseen for it.

At the end of 2016, 42,285 m<sup>3</sup> LILW and VLLW had been disposed of in the country, of which about 31% could be categorized as VLLW. Additionally, 11,020 m<sup>3</sup> of VLLW and 6,836 m<sup>3</sup> of LILW were stored. Disposed waste is in El Cabril while temporarily stored waste is mainly in the centers where it was generated. On that same date there were 185 m<sup>3</sup> of Special Waste mainly stored at NPP Vandellós I and at NPP José Cabrera. As for the HLW, about 4,975 tU have been generated in the Spanish NPPs. As regards the small quantities of SF sent abroad, the return from France of 2m<sup>3</sup> of HLW is expected.

The long-term estimation of waste production is organised around a central scenario where it is assumed that NPPs will be operational for a lifetime of 40 years. In those conditions, the expected amounts of SF and radioactive waste would be those shown in Table 1.

	Type	Total Amount
<b>LILW</b>  + <b>VLLW</b>	LILW	56,000 m <sup>3</sup>
	VLLW	120,000 m <sup>3</sup>
	TOTAL LILW+VLLW	176,000 m <sup>3</sup>
<b>ILW-LL</b>  <b>(Special Waste)</b>	Canister CSD-B	12 m <sup>3</sup>
	Canister CSD-C	2 m <sup>3</sup>
	Waste from reactors dismantling	530-600 m <sup>3</sup>
	TOTAL Special Waste	544-614 m <sup>3</sup>
<b>SF (UO<sub>2</sub>)</b>	PWR	5136 tU
	BWR	1504 tU
	TOTAL SF	6640 tU

Table 1. Long term estimates of waste generation according to the GRWP

## **RADIOACTIVE WASTE MANAGEMENT POLICIES AND PROGRAMMES**

### **Waste management policies**

The setting of policies and strategies on radioactive waste management, as well as the scheduling of major related activities, are a responsibility of the Government. This task is delivered by means of legislative proposals as well as the issuing of the National Program or General Radioactive Waste Management Plan (GRWP). The main policy principles are aligned with those set up in international conventions and treaties, particularly those included in EURATOM legislation:

- The generation of radioactive waste shall be minimized as far as reasonably practicable;
- The interdependence between all stages of generation and management of spent fuel and radioactive waste shall be taken into account;
- Spent fuel and radioactive waste shall be safely managed, even in the long-term including passive safety systems;
- The cost of the management of spent fuel and of radioactive waste will be borne by those who have generated such materials;
- The implementation of measures for the safe management of spent fuel and radioactive waste will respond to a graduated approach process;
- Empirical evidence-based decision-making shall be applied and documented at all stages of the management of spent fuel and radioactive waste.

While the prime responsibility for RW management rests on the waste producers, the ultimate one corresponds to the State. Radioactive waste management is essential public service to be discharged by the central administration and whose technical arm (implementer) is the Empresa Nacional de Residuos Radiactivos S.A. (Enresa).

As for the strategy in the GRWP, the Plan sets the strategies and main activities to be carried out by ENRESA in regard to its remit. It is drafted by this agency and sent to the Ministry in charge of energy matters who, after approval, submits it to the Government. Once it is finally passed, the Government sends it to the Parliament for information. A draft of the Plan is submitted every four years to the Ministry for its consideration.

### **Programmes and projects**

#### ***Nuclear fuel waste***

The reference solution for SF, HLW, ILW and other long-lived waste, in the long term, is its disposal in a deep geological repository. In the case of SF that will be in the form of direct disposal as reprocessing is not considered an option since 1984.

All the spent fuel generated by the Spanish LWRs (Light Water Reactors) has been stored on site. In the early days of the operation of the NPPs, storage was implemented in the plants' pools. Some 10 to 15 years later, throughout the 1990's, and in view of the foreseen saturation of the capacity of these pools, the original storage racks were progressively replaced with other more compact units. Saturation was thus delayed but, at the turn of the century, additional

storage capacity was needed in most of the NPPs, so that individual storage facilities (ISF) were progressively commissioned and built on the site of many NPPs.

In the medium term, the main strategy for SF, HLW and special waste is to store all of them in a single site or Centralised Storage Facility (CIS). The municipality of Villar de Cañas, in the province of Cuenca, was designated as the preferred site in 2012. Presently, Enresa is involved in the process of getting the site and construction license. Until this facility becomes operational, SF will continue to be temporarily stored in the NPPs sites.

### ***Low and intermediate level radioactive waste (LILW)***

Since 1992, Spain has a near surface disposal facility for LILW in El Cabril in the province of Córdoba. In the same site there are also two disposal cells for VLLW (start of operation in 2008) and a series of facilities where the waste coming from institutional producers or the secondary waste generated in El Cabril can be treated, incinerated, and conditioned. Capacity for LILW is 50,000 m<sup>3</sup>, while the existing one for VLLW is around 60,000 m<sup>3</sup>.

El Cabril is the cornerstone of the Spanish system for managing any low activity radioactive waste. Any waste not suitable to be disposed of at El Cabril will be stored at the Centralised Storage facility mentioned before.

### ***Decommissioning and dismantling policies and projects***

The decommissioning policy and strategy are set in the GRWP and have been basically the same since the first plan in 1987. The Spanish policy and strategy is that of immediate decommissioning up to “green field” conditions. The strategy allows a deferred dismantling alternative only in those cases where the optimisation of doses or any technological particularity of the plant make it more advisable. In practice, immediate dismantling is a suitable strategy for all Spanish NPPs except Vandellós 1, this latter being a graphite-gas reactor.

Taking into account the need of transferring the licence from the operator of the NPP to Enresa, the GRWP assumes a 3 year transition period for the discharge of the spent fuel and conditioning of the waste and a 10 year period for completing the different decommissioning tasks.

Enresa’s current and recent work in the dismantling and decommissioning of nuclear facilities includes the decommissioning of NPP José Cabrera, the latency of Vandellós I, the dismantling of obsolete installations of the former national lab CIEMAT (so called “PIMIC project”), the monitoring and maintenance of the project restoration of Saelices el Chico (Salamanca), the preparation for decommissioning of Santa María de Garoña and other minor actions. It is expected that the decommissioning of José Cabrera will be completed by 2020. Vandellós-1 is in a latency period, its dismantling deferred for at least 25 years. It is foreseen that Garoña decommissioning will start around 2022.

## **RESEARCH AND DEVELOPMENT**

### ***Responsibilities***

Spanish legislation states that the GRWP shall include the RD&D activities needed to apply solutions for the management of spent nuclear fuel and radioactive waste, as well as to carry out the dismantling and decommissioning of nuclear facilities. To this end Enresa is entrusted with the establishment of the training and RD&D plans needed, within the framework of the Scientific and Technical Research and Innovation State Plan, to cover the needs of the GRWP and to acquire, maintain and further develop the necessary knowledge and skills. There is also an initiative led by the CSN and arranged around the Research and Development Plan.

### ***Research activities***

#### *7th R&D Plan of Enresa (2014-2018)*

This Plan is the specific plan for R&D in radioactive waste management that focuses its efforts on RD&D in areas where there are potential for improvement and optimization. In accordance with the 6th GRWP in force, the 7th Plan includes four technical areas of work (Waste technology and know-how, Technology for treatment, conditioning and dismantling processes, Confinement systems and materials, and Safety assessment and modelling). This plan covers four thematic areas and a cross-activity. The four areas relate to the precise knowledge of the waste, both of their intrinsic properties and their evolution over time; treatment and conditioning of waste and its relationship with the techniques of operation and decommissioning of radioactive and nuclear facilities; the study of materials used for their confinement and their interrelationships with RW; their impact to the environment considering current and future scenarios, and related to radiation protection of human and environmental studies. Enresa is the drafter of the Plan as well as the leader for its implementation. The budget for the 7<sup>th</sup> R&D Plan is 27 million euros.

#### *R&D Plan of CSN*

The Spanish Nuclear Safety Council (CSN) develops R&D plans to respond to new challenges in knowledge brought to light by the CSN's own and international experience and technological changes requiring new approaches. CSN's R&D plans define strategic priorities (areas of knowledge in which new developments are needed) and leading lines of research (programs) in those areas. Plans are developed with a five-year horizon in mind. For its development, the CSN promotes several projects, which are executed under its supervision by domestic and well-known international organizations.

## **TRANSPORT**

Transportation of radioactive waste and spent fuel is a responsibility of Enresa which can deliver the service by its own means or by way of subcontracting specialized companies. Most of the waste shipments are done by road while sea transportation is just for those packages coming from the islands (Canary Islands, Balearic Islands). In practice, Enresa only transports waste from institutional producers. That originated at the NPPs is carried out by companies specialized in transport of nuclear materials.

## **COMPETENT AUTHORITIES**

### **Regulation and licensing**

The Ministry for Ecological Transition (MITECO) is in charge of energy and environmental matters. In this role, the Ministry defines the policy and strategy in relation to

radioactive waste, spent nuclear fuel management and decommissioning of nuclear facilities. It is also responsible for the submission of regulatory proposals for the development of the legislation, for the issuing of the corresponding permits and licenses and for applying the system of sanctions.

The Nuclear Safety Council (CSN) is the solely body responsible for nuclear safety and radiation protection. The licenses awarded by the MITECO are subject to a previous, mandatory and binding CSN report.

### **Implementing agencies**

The Empresa Nacional de Residuos Radiactivos (Enresa) is responsible for SF, radioactive waste management and decommissioning of nuclear facilities. Being entirely public in nature, ENRESA has as its shareholders the Centre for Energy-Related, Environmental and Technological Research (CIEMAT), a national research centre reporting to the Ministry of Science, Innovation and Universities, and the Spanish industrial holding company Sociedad Española de Participaciones Industriales (SEPI), which reports to the Ministry of Finance. ENRESA operates under the aegis of the MITECO, via the Secretariat of State for Energy, which undertakes strategic management and monitoring and control of the company's technical and economic actions and plans.

### **FINANCING**

By Law, the money to pay for the costs of the activities for radioactive waste management will be taken from a Fund, external to the waste producers, fed by them and managed by Enresa with the supervision of the Government.

The licensees of the nuclear facilities, as most significant waste generators, are the main contributors to the Fund. They are obliged to feed the Fund paying fees during the operational lifetime of their facilities. These payments are advanced revenues that cover present and future costs, i.e. they include the management of the waste generated during the operation of the facility as well as the costs of the decommissioning and dismantling activities and management of the waste originated during dismantling. On the conclusion of the period for radioactive waste management and dismantling of facilities set out in the General Radioactive Waste Plan (GRWP), the total amount paid into the Fund via the different financing channels should cover the costs incurred, resulting in a closing balance of zero.

The revenues obtained in the Fund are invested in the financial market, and those assets also generate revenues that, by turn, feed the fund. The law stipulates that such investment operations may only be carried out following the principles of security, profitability and liquidity.

On the side of costs estimation, the GRWP must set out the economic and financial forecasts and the measures and procedures necessary to implement the detected strategies and technical solutions for RW management and decommissioning of nuclear facilities. To this end, every Plan includes an estimation of all costs during the lifecycle of the waste and the corresponding facilities. This estimation is the basis to set the fees paid by the different producers and is reviewed every time that the Plan is. Additionally, Enresa must send annually to MITECO an updated economic-financial study of the cost of the activities under the GRWP.

### **PUBLIC INFORMATION**

The Ministry for Ecological Transition (MITECO)

October 2018

<https://www.mapama.gob.es/es/ministerio/>

The Spanish Nuclear Safety Council (CSN)

<https://www.csn.es/>

Empresa Nacional de Residuos Radiactivos S.A. (ENRESA)

[www.enresa.es/](http://www.enresa.es/)

Centre for Energy-Related, Environmental and Technological Research (CIEMAT)

[www.ciemat.es/](http://www.ciemat.es/)