

RADIOACTIVE WASTE MANAGEMENT PROGRAMMES IN OECD/NEA MEMBER COUNTRIES

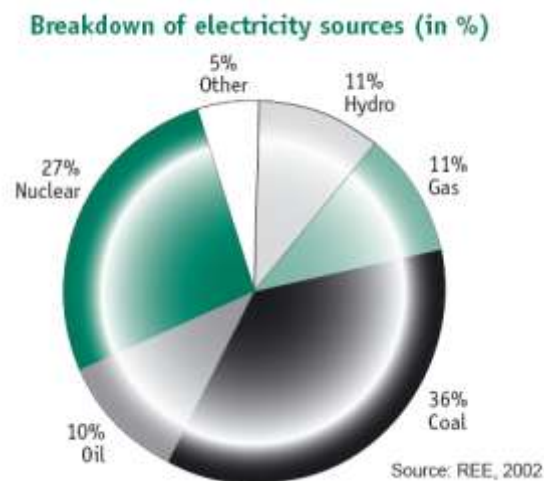
SPAIN [2005]

NATIONAL NUCLEAR ENERGY CONTEXT

Commercial utilisation of nuclear power in Spain started in 1968 and by 2002 there were 9 nuclear power units connected to the electricity grid. In 2002 they generated 63 TWh of electricity, 27.2% of the total electricity generated in that year.

Also in 2002, the capacity for nuclear fuel fabrication was 300 tonnes heavy metal per year (HM/year) of uranium fuel for light water reactors. Spent fuel storage capacity was 4 911 tonnes HM, and the amount of spent fuel arising in 2002 was 145 tonnes HM.

The most significant recent event in the context of nuclear energy was the granting, in October 2002, of a new operating licence for the José Cabrera nuclear power plant (NPP). It is authorised to operate until April 2006, when it will be finally shut down.



SOURCES, TYPES AND QUANTITIES OF WASTE

Radioactive waste generation began in Spain during the 1950s with the first use of radioactive isotopes in industrial, medical and research institutions. There are currently more than one thousand such institutions authorised to use radioactive isotopes, and described as “small producers” of radioactive waste. However, most radioactive waste is generated from operation and dismantling of nuclear power plants and, in smaller quantities, from the fabrication of nuclear fuel.

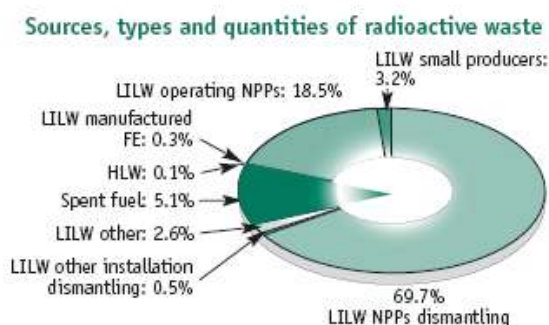
Those wastes containing low or medium levels of activity consisting mainly of short-lived radionuclides are generally described as low- and intermediate-level radioactive waste (LILW). Other wastes containing higher levels of activity and those containing long-lived radionuclides are described as high-level waste (HLW). In addition, spent nuclear fuel from the nuclear power plants is recognised as a specific type of HLW waste in its own right.

In 2002, about 1 694 m³ of conditioned LILW was produced, and at the end of that year a cumulative total of some 31 000 m³ of conditioned LILW was in storage in Spain.

The quantity of spent nuclear fuel in storage at the end of 2002 was about 2 885 tonnes HM. In due course, a quantity of HLW will be returned to Spain from abroad. This will comprise vitrified highly active residues from the reprocessing of spent fuel from the Vandellós I NPP together with minor quantities of fissionable materials recovered during reprocessing of spent fuel from the Santa María de Garoña NPP before 1983.

Based on the current installed nuclear power capacity, and on a nuclear power plant lifetime of 40 years, the total, eventual amount of LILW to be managed will be approximately 200 000 m³. The total amount of HLW will be some 10 000 m³, the volume equivalent to 6 750 tonnes HM of spent fuel, together with some vitrified HLW.

The table below summarises the amount of radioactive wastes to be managed as estimated to December 2002.



Waste type	Source	Quantity (in m ³)
LILW	Fuel fabrication	520
	NPP operation	36 620
	Small producers	6 280
	NPP dismantling	137 640
	Other installation dismantling	1 060
Other sources	5 230	
Spent fuel	NPP	10 000
HLW	NPP	80

RADIOACTIVE WASTE MANAGEMENT POLICIES AND PROGRAMMES

Spain has an almost complete nuclear fuel cycle comprising uranium mining, production of uranium concentrates, fabrication of nuclear fuel, generation of nuclear power and radioactive waste management. Uranium enrichment is carried out abroad. There are no reprocessing facilities. The only SF reprocessed to date has been that generated by Vandellós I NPP, sent to France, and certain amounts sent to Great Britain by the José Cabrera and Santa María de Garoña plants prior to 1983. Spent fuel is now stored at the nuclear power stations where it arises. Low- and intermediate-level waste (LILW) generated in nuclear and other facilities, including waste arising from decommissioning, is disposed of in a near-surface repository. There is no military nuclear programme in Spain.

Waste management policies

Radioactive waste management and planning strategies, and the scheduling of major related activities, must be approved by government. Accordingly, the Royal Decree that led to creation of the Empresa Nacional de Residuos Radioactivos, S.A. (ENRESA), the body responsible for radioactive waste management activities in Spain, requires the company to draw up an annual report describing the actions taken during the previous financial year, together with a revised version of its current General Radioactive Waste Plan. This Plan makes proposals for the strategies and main activities to be carried out by ENRESA in regard to its remit. It is submitted by the Ministry of Economy to the Government for approval, and where appropriate, with subsequent notification to Parliament.

Programmes and projects

Low- and intermediate-level waste (LILW)

The strategy for management of LILW is based on the inter-related requirements for the waste to match the requirements of the disposal facility and for the disposal facility to be designed so as to accommodate the wastes. Two major areas of action flow from this. The first concerns the conditioning, transport, characterisation and criteria for acceptance of radioactive wastes, and the inspection arrangements required to guarantee compliance with acceptance criteria. The second concerns the design, construction and operation of the disposal facilities.

Except in the case of small producers, the initial treatment and conditioning of LILW is the responsibility of the producer, who is obliged to produce waste packages that satisfy acceptance criteria defined by ENRESA. These criteria are approved by the safety authorities for subsequent conditioning and disposal at the El Cabril disposal centre. In the case of small producers, all necessary waste treatment and conditioning is carried out at the El Cabril facility.

The contracts between ENRESA and the waste producers set out the acceptance criteria for disposal of wastes at El Cabril and the technical specifications for characterisation and acceptance of wastes. A key element of the latter process is the waste quality verification laboratory.

El Cabril disposal centre

ENRESA has operated the El Cabril disposal centre since 1992, with the objective of securing safe disposal of the LILW produced in Spain. This centre is located in the northwest of Córdoba province, in the municipal district of Hornachuelos. Preparatory work for the facility started in 1986, construction started in January 1990 and authorisation for start-up was received in October 1992.

The centre has two main areas, one for waste disposal and the other for waste conditioning and auxiliary buildings, including the waste quality verification laboratory.

The disposal system comprises a set of multiple barriers. The waste packages are immobilised by cementation within concrete containers measuring 2.25 x 2.25 x 2.20 metres, the whole constituting a block weighing some 24 tonnes. These containers are emplaced in disposal vaults, each of which has a capacity for 320 containers. The containers are placed in contact with each other, a central cross or strip being left to allow for the manufacturing and positioning tolerances of the container. The base slab of the platforms on which the disposal vaults rest constitutes the main element of the overall assembly. Its functions are to provide mechanical support and to collect any water that might infiltrate the system and channel it to a network of pipes installed in accessible galleries below the platforms, thus providing a control network.

The capacity of the El Cabril centre is envisaged as being sufficient for LILW disposal in Spain until about 2020.

The centre is also equipped to treat the so-called “institutional” wastes from small producers, to reduce the volume of compactable wastes, to condition wastes generated in the facility itself and to recondition the waste packages using concrete containers. The waste conditioning systems and the disposal systems are both remotely controlled from the control room, the only exceptions being the handling of certain wastes with very low contact dose-rates, from small producers, and operation of the incinerator.

Spent fuel (SF) and high-level waste (HLW)

The approach adopted in 1999 by the current, 5th General Radioactive Waste Plan as regards policy for management of spent fuel (SF) and high-level waste (HLW) reflects both the domestic situation in Spain and the general, international position on these matters. A distinction is made between interim and final technological solutions, recognising the need for further analysis of long-term options.

The strategy for the interim storage of SF and HLW involves the following steps:

- An increase in the SF storage capacity of reactor pools, as far as possible by means of re-racking. Completed by 1999.
- Provision of additional SF storage capacity using casks, which included the construction of a temporary storage facility. In operation for Trillo NPP since 2002.
- Construction of a centralised interim storage facility by 2010, in order to accommodate returned HLW, in the form of vitrified wastes and fissionable materials, arising from reprocessing abroad. This facility will also be required to store other wastes that cannot be disposed of at the El Cabril disposal centre, as well as SF that cannot be accommodated at the NPPs for lack of capacity in reactor pools or because of their future dismantling.

These steps will allow sufficient time for defining the complete programme for management of SF and HLW. The 5th General Radioactive Waste Plan aims to bring together the investigations for a Deep Geological Disposal (DGD) facility and for separation and transmutation of long-lived radionuclides. This will allow analysis of options, involving combination of these techniques, so as to provide Government with the necessary information for making its decision.

The Plan states that no decision on the eventual fate of SF and HLW will be taken before 2010. In the meantime, the main activities will be as follows:

- No further geological studies will be performed until this decision is taken and, instead, existing geological data will be used for performance assessment of a DGD facility.
- Non site-specific conceptual repository designs for DGD repositories in granite, clay and salt will be modified to introduce the capability for retrieving emplaced waste.
- Safety performance assessment of DGD repositories will combine geological information, repository design and the results of R&D. These assessments will provide quantitative information about evolution of the repository for guiding R&D activities and optimising facility designs. These studies will also consider the possible effects of the new fuel cycle technologies associated with separation and transmutation of the long-lived radionuclides.

The ENRESA work programme is being modified in accordance with this Plan, and currently involves the following items:

- A report on management options for SF and HLW
- Integrated studies on non site-specific deep geological repositories, one in each of the granite, clay and salt formations.
- A compilation of the R&D results and geological information from the former Site Selection Plan.

A non-site-specific performance assessment of disposal in granite (ENRESA-2000 granite) was completed at the end of 2001. A similar exercise for disposal in clay was finished in 2004. A first revision of an integrated study for a deep geological repository in granite (AGP Básico Granito 2003) was finished at the end of the year 2003.

RESEARCH AND DEVELOPMENT

The Spanish Government recognises the importance of research and development in providing sound support for radioactive waste management projects, and entrusted ENRESA with responsibility for structuring and developing R&D plans according to strategic, project-related needs. ENRESA does not itself carry out R&D activities. Within the framework of the multi-annual R&D plans, it promotes, coordinates, controls and finances research activities through contracts with research institutes, universities and/or industrial companies.

An important feature of ENRESA's R&D activities is collaboration on international projects with international bodies and with other countries. Participation is by way of bilateral agreements, involvement in the working groups of the International Atomic Energy Agency (IAEA) and the OECD Nuclear Energy Agency (NEA), and by way of the European Union research programmes, either directly or through third parties. Projects are funded directly by ENRESA, by other participants in co-operation projects, and by the European Commission (EC) in the case of EC Shared-Cost Programmes.

The current plan covers the following areas of activity:

- basic technologies of waste characterisation and behaviour, applicable to various fields of management undertaken by ENRESA;
- separation and transmutation;
- disposal;
- performance and safety assessment;
- support of facilities: LILW, dismantling and radiological protection.

DECOMMISSIONING AND DISMANTLING POLICIES AND PROJECTS

From the point of view of technological development and radioactive waste production, decommissioning of nuclear power plants is the most important issue in this area. Decommissioning of the Vandellós I NPP is of particular current importance, with the decommissioning of other NPPs already in view for the medium term. The decommissioning and dismantling plan for Vandellós I NPP was approved by the government in January 1998. The technical option selected was deferral of final dismantling and site clearance for about 25 years with safe enclosure of the reactor core in the interim. Dismantling of peripheral equipment and facilities was completed by ENRESA in summer 2003 and the period of safe enclosure started.

For planning purposes, it is estimated for other nuclear power plants that complete dismantling will take place within three years of final shutdown of the reactors.

TRANSPORT

Spanish transport regulations are based on the International Atomic Energy Agency Regulations for the Safe Transport of Radioactive Materials. In addition, however, ENRESA must give advance notice of its shipments to the Nuclear Safety Council, the Civil Protection Board, the Police and to other administrative authorities. Prior to any shipment, ENRESA inspects and checks all technical and administrative aspects of the waste and of the vehicles involved. The Spanish Nuclear Safety Council inspects some 100 shipments per year. A special contingency plan has been developed in accordance with the requirements of the Civil Protection Board for the event of any incident during transport.

At the present time, only LILW is transported, as there are no disposal or central storage sites for SF and HLW. LILW is delivered to the El Cabril site regardless of origin, be it nuclear facilities or small users. Transport is by road in ENRESA-designed vans or semi-trailers and currently involves about 275 shipments per year, and 250 000 km of road travel.

COMPETENT AUTHORITIES

By law, the **Ministry of Economy (MINECO)** is responsible for enforcing nuclear legislation and for granting licenses, subject to a mandatory and binding report from the **Nuclear Safety Council (CSN)**. The CSN was set up in 1980 as the only competent body in matters of nuclear safety and radiological protection, and is generally responsible for the regulation and supervision of nuclear installations. This body, governed by public law, is independent of the state administration and reports directly to Parliament.

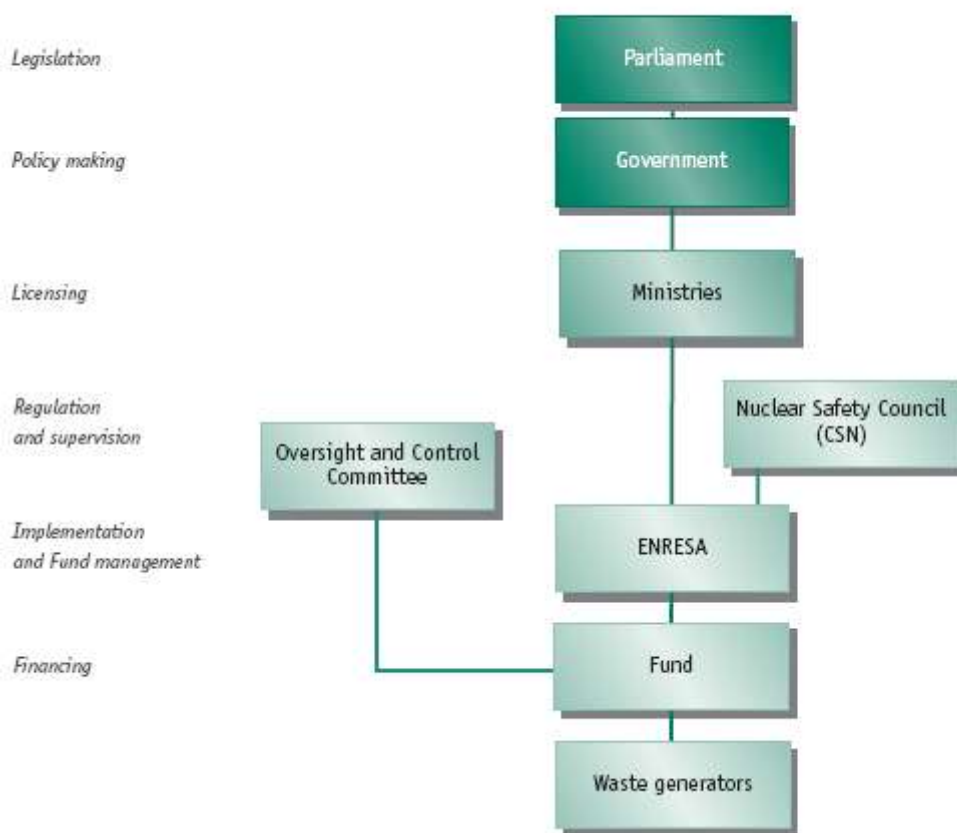
The **Ministry of Environment** participates in the licensing process, in collaboration with the CSN, by providing an environmental impact assessment, as do regional and local governments in the areas under their competence.

The **Empresa Nacional de Residuos Radioactivos, S.A. (ENRESA)** was set up in 1984 to be responsible for radioactive waste management and decommissioning of nuclear facilities in Spain. It is a state-owned company whose shareholders are the **Centro de Investigaciones Energéticas, Medioambientales y Tecnológicas (CIEMAT)** and the **Spanish State Industrial Holding (SEPI)**, both governmental institutions. ENRESA operates as a management company whose role is to develop radioactive waste management programmes according to policy and strategy approved by the Spanish Government, by way of a General Radioactive Waste Plan proposed by ENRESA.

The activities for which ENRESA is responsible are as follows:

- handling, treatment and conditioning of radioactive waste in some specific cases (for instance small producers);
- site design, construction and operation of centralised storage and disposal facilities;
- setting up of the necessary systems for collection, transfer and transport of radioactive wastes;
- decommissioning and dismantling of nuclear installations;
- conditioning of uranium mining and milling tailings when required;
- support to civil protection services in cases of nuclear emergency.

Main bodies involved in radioactive waste management in Spain



FINANCING

In accordance with the 1984 Royal Decree that established ENRESA, a system for funding radioactive waste management has been set up and is based on payment on account into an interest-earning fund. This takes account of the delay between the time of waste production and the time when the main costs of its management are incurred.

The funds for meeting the costs of the back-end of the nuclear fuel-cycle and of reactor decommissioning are collected by way of a levy on all the electricity sales. This levy is calculated on a yearly basis taking account of a revised appraisal of costs and the level of available funds. Thus the revenues to cover the difference between costs and available funds should be collected during the operational lifetime of the NPPs, currently foreseen as being 40 years.

In the case of the small producers, a system of tariffs has been defined by the Government for payment to ENRESA for the services rendered.

Every year, ENRESA updates its forecast of the income required. This forecast is included in the General Radioactive Waste Plan, which is sent for approval to the Ministry of Economy, which then takes the document as its main reference for fixing the applicable levy by way of the Royal Decree on Electricity Tariffs.

PUBLIC INFORMATION

For more information, the websites of the relevant authorities and organisations are listed below.

Industry

Information on radioactive waste management issues is mainly provided by ENRESA, either in the visitor centres or through periodical publications, brochures, videos, etc. Five visitors centres are presently open, at ENRESA Headquarters in Madrid, ENRESA offices in Córdoba and three corresponding to the locations where ENRESA is carrying out its activities at the El Cabril site, Vandellós I plant and the former uranium mining and milling facility at Andújar.

ENRESA

Madrid

Website: www.enresa.es

E-mail: sopcom@enresa.es

Government

The Nuclear Safety Council is also responsible for keeping the public informed, either by way of its visitors centre or through periodical publications.

Consejo de Seguridad Nuclear

Madrid

Web site: www.csn.es

E-mail: comunicaciones@csn.es