

RADIOACTIVE WASTE MANAGEMENT PROGRAMMES IN OECD/NEA MEMBER COUNTRIES

SPAIN [2013]

NATIONAL NUCLEAR ENERGY CONTEXT

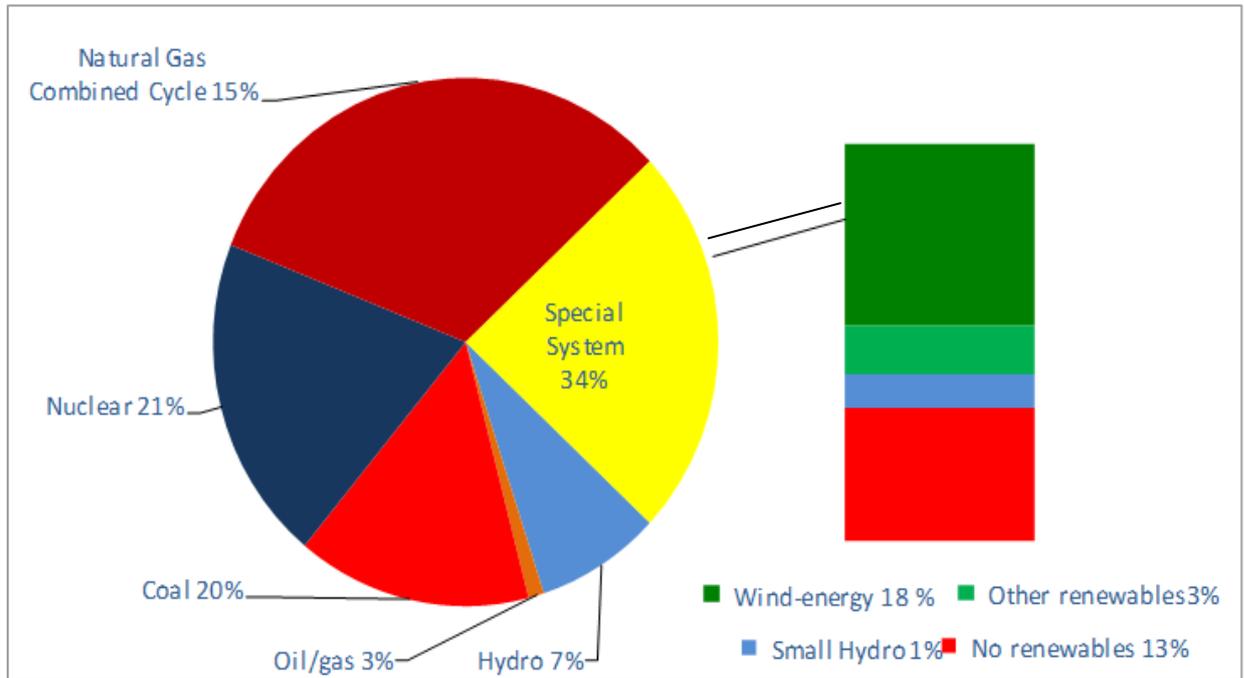
Commercial utilization of nuclear power in Spain started in 1968 and by 2012 there were 8 nuclear power units. In 2012 they generated 61.4 TWh of electricity, roughly 21% of the total electricity production that year.

Presently, the only steps of the nuclear fuel cycle in Spain are the fabrication of nuclear fuel, the generation of electricity and radioactive waste management. Uranium enrichment is carried out abroad and there are no 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 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 (either within swimming pools or dry Interim Storages). 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. There is no military nuclear program in Spain.

Also in 2012, the capacity for nuclear fuel fabrication was 400 tons heavy metal per year (tHM/year) of uranium fuel for light water reactors.

The decommissioning and dismantling of José Cabrera NPP was approved by the Government in 2006 and the schedule of these activities covers the period 2010 to 2016.

Spain has kept the same nuclear energy policy during the last years. A recent event in the context of the nuclear fuel cycle was the designation by the Spanish Government at the end of 2011 of the site of the Centralized Interim Storage Facility. This installation is to house all the spent fuel from the nuclear power plants and the high level wastes produced in Spain as well as radioactive waste with medium level activity and long-life radionuclides that cannot be disposed of in the Cabril.



(Source: Red Eléctrica de España, S.A.)

Figure 1. Breakdown of electricity sources in 2012(%)

SOURCES, TYPES AND QUANTITIES OF WASTE

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

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

In 2012, about 1,956 m³ of conditioned VLLW and LILW was produced, and at the end of that year a cumulative total of some 33,720 m³ of conditioned VLLW and LILW has been disposed of.

The quantity of spent nuclear fuel in storage at the end of 2012 was 12.906 fuel assemblies (about 4,225 tHM). The average occupancy rate of the pools of the nuclear power plants was 82 %. In due course, once the Centralized Facility Storage building is in operation a quantity of HLW will be returned to Spain from abroad. This will comprise vitrified highly active residues from the reprocessing in France of spent fuel from the Vandellós I NPP.

Based on the current installed nuclear power capacity, and on a nuclear power plant lifetime assumption of 40 years, the total eventual amount of VLLW and LILW to be managed will be approximately 181,000 m³. The total of HLW will be some 6,700 tons of spent fuel, together with some vitrified HLW. Apart from these wastes, it has been estimated that 890 m³ of long-lived, non-heat generating waste will also require to be managed.

The table below summarizes the amount of radioactive wastes to be managed as estimated by December 2012.

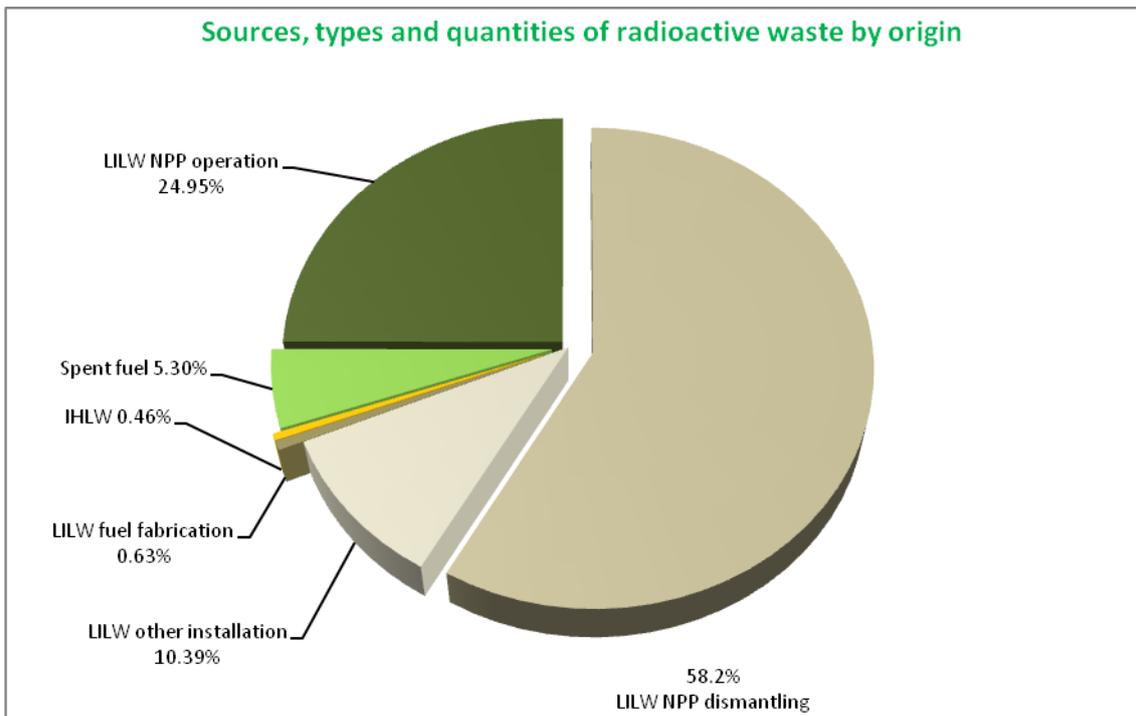
Waste type	Source	Amount (m ³)
LILW (*)	NPP Operationing	48.000
	NPP Dismantling	112.000
	Other Installations	20.000
	Fuel Fabrication	1.220
Spent fuel	NPPs	10.200
IHLW (**)	NPPs and others	890

(*) Including VLLW

(**) Including Medium Level Radioactive waste that has no place in The Cabril.

Source: Enresa

Table 1. Sources, types and quantities of radioactive waste to be managed in Spain



(Source: Enresa)

Figure 2. Breakdown by sources of radioactive wastes to be managed in Spain

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 competence of the Government. Accordingly, the Royal Decree that led to the creation of the Empresa Nacional de Residuos Radiactivos, S.A (ENRESA), the body responsible for radioactive waste management activities in Spain, requires the company to draw up and submit every four years a revised version of the General Radioactive Waste Management Plan.

The Plan sets the strategies and main activities to be carried out by ENRESA in regard to its remit. It is submitted by the Ministry of Industry, Energy and Tourism to the Government for approval, once received the CSN report, and where appropriate, with subsequent notifications to Parliament.

Programs and projects

Very Low (VLLW), Low-and intermediate-level waste (LILW)

The strategy for managing LILW is based on the need of the waste matching the requirements of the disposal facility and 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, characterization and criteria for acceptance of radioactive wastes, as well as the inspection arrangements required to guarantee compliance with these latter. The second concerns the design, construction and operation of the disposal facilities.

Except in the case of institutional producers, the initial treatment and conditioning of VLLW and LILW is the responsibility of the producer, who is obliged to produce waste packages that satisfy the acceptance criteria defined by ENRESA. These criteria are approved by the safety authorities for subsequent conditioning and disposal at the El Cabril center. In the case of small producers, all necessary waste treatment and conditioning is carried out at this facility. A key element in the process is the waste quality verification laboratory in El Cabril.

El Cabril disposal centre

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

The Centre has three main lines of activity, two for waste disposal (VLLW and LILW) and the other for waste conditioning and auxiliary buildings, including the above-mentioned waste quality verification laboratory.

The disposal system for LILW is near-surface comprising a set of multiple barriers. The waste packages are immobilized by cementation within concrete containers, the whole constituting a block which is emplaced in disposal vaults, each of which has a capacity for 320 containers.

The group of low and intermediate level wastes also includes what are known as very low level wastes (VLLW), which in view of their low radioactivity content entail less demanding requirements for their management. The disposal system is land-fill type.

In general, very low activity waste present specific activities between 1 and 100 Becquerel per gram, but could go up to several thousand in the case of some low toxicity radionuclides. Most of this waste comes from decommissioning of nuclear facilities and potential incidents involving radioactive materials.

The center is also equipped to treat the so-called “institutional” waste from small producers, to reduce the volume of compactable wastes, to condition waste 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 waste with very low contact dose-rates and the operation of the incinerator.

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

In general the SF generated in Spain is stored on the site of the NNPs, in the storage pools and in some cases in dry storage systems. The exception is NPP Vandellós I whose spent fuel was reprocessed in France.

The historical strategy for the interim storage of SF and HLW was originally oriented to provide enough additional storage capacity as to not compromising the operation of the NNPs, following several steps:

- An increase in the SF storage capacity for reactor pools, as far as possible by means of re-racking which was completed by 1999 with the exception of Cofrentes NPP which faced a second phase of re-racking completed by 2009.
- Provision of additional SF storage capacity on reactor site using dry storage systems, which included the commissioning of temporary dry storage facilities for Trillo NPP (2002), for José Cabrera NPP (2009) and for Ascó I NPP (2013).
- Later on, the target was the optimization of the interim storage infrastructure while waiting for the implementation of long-term management facilities by means of the Construction of a Centralized Interim Storage Facility (CISF), in order to accommodate all SF, and the returned HLW arising from reprocessing abroad. This facility will also be required to store other long-lived medium level wastes that cannot be disposed of at the El Cabril disposal center.

These steps will allow sufficient time for defining the complete program for the final management of SF and HLW.

On this respect it should be pointed out that in Spain work on the deep geological disposal option has been on-going since 1985, in 4 basic areas:

- Site Selection Plan (SSP), which was stopped in 2006 and that has provided sufficient information to ensure the existence in the sub-soil of an abundance of granite and clay and, to a lesser extent, salt formations capable of housing a definitive disposal installation, these being widely distributed geographically;
- Performance of conceptual designs for a definitive disposal facility in each of the aforementioned lithology, searching for the maximum convergence between them;
- Performance of safety assessment exercises with respect to the conceptual designs, integrating the know-how achieved through the works and projects performed on the basis of the successive R&D Plans;
- R&D Plans that have evolved and adapted to the Spanish SF/HLW management program. These Plans have allowed the acquisition of technical knowledge and the training of national working teams in the development of the definitive disposal option. They have also facilitated the participation in international research projects and in demonstration projects in foreign underground laboratories.

Since the approval of the 6th GRWMP, the major strategy has been the consolidation and updating of the knowledge acquired, taking advantage of international developments in the field. In this respect, the ongoing activities in this area are as follows:

- Documents are being drawn up summarizing the information acquired to date, with site selection activities not being resumed;
- The generic designs for each host rock are being consolidated;
- The corresponding safety assessment exercises are being revised and updated on the basis of progress made in R&D programs, in keeping with the revised designs and international projects.

RESEARCH AND DEVELOPMENT

Responsibilities

MINETUR

It contributes to defining the R&D policy in the nuclear sector in coordination with the Ministry of Science and Innovation. In this respect, in response to an initiative by the MITYC, the Strategic Nuclear Energy R&D Committee (CEIDEN), the predecessor of the current Nuclear Fission Energy R&D Technology Platform, was set up in 1999, the aim being to bring together all the different agents involved in the nuclear energy sector, including in addition to the MITYC itself, the CSN, universities and research centers, operators and industry associations, with a view to identifying synergies and points of common interest in the research activities and programs carried out by them and to participating in international programs

ENRESA research and development activities

The Royal Decree 1349/2003 of 31st October on the governance activities performed by ENRESA states that this Agency has the mission of establishing the R+D plan required for the performance of its functions.

The ongoing R&D Plan (2009 to 2013) is focused on giving support to all operating ENRESA's facilities, such as the Cabril Low, Medium & Very Low Radioactive Wastes installation, the Jose Cabrera Nuclear Plant and the temporary spent fuel management, particularly with respect to the design, licensing and construction of the Centralized Interim Spent Fuel and High Level Radioactive Wastes Storage Installation (CISF).

The development topics to deal with are:

- Waste technology,
- Processing, conditioning and dismantling,
- Confinement systems and materials,
- Radiological protection, environmental restoration and models, and
- Knowledge coordination and management.

Final management of spent fuel is also approached within the R&D taking part in EU Framework Program projects, NEA-OCDE Working Groups and participating in the IGD-TP Platform in which ENRESA takes part in the Executive Group.

ENRESA takes part as well in the Spanish platform of the Nuclear R&D (CEIDEN).

Facing the future, the construction and start of operation of the Technological Center associated to the CISF is the main challenge for the R&D for the spent fuel temporary and final disposal and for the High Level Radioactive Wastes.

CSN'S Regulatory research activities

According to the Law 33/2007, of 7th November, amending Law 15/1980, of 22nd April, creating the Nuclear Safety Council, the CSN is responsible for setting-up and monitoring research plans within the field of nuclear safety and radiological protection. The CSN corresponding strategic objective for the period 2011-2016 is to reinforce the Council's R&D activities in the establishment and follow-up of research plans relating to nuclear safety and radiological protection.

Research, development and innovation in all areas relating to nuclear safety and radiological protection are activities that the CSN promotes, supervises and funds in order to increase the scientific capacity of its technical staff, since the control of the safety of the Spanish nuclear and radioactive facilities and the Technical Proposals drawn up by the CSN require professional qualification and experience of the highest level. The lines of research on which the CSN bases its activities are fundamental as a scientific and technical basis for the subsequent processes of analysis and decision-making. In accordance with the standards established in the CSN Research Plan, these activities are carried out in collaboration with other institutions, the most noteworthy being collaboration with the association of electricity utilities UNESA (Coordinated research plan) and with ENRESA and CIEMAT, as well as with certain of the Spanish universities.

DECOMMISSIONING AND DISMANTLING POLICIES AND PROJECTS

The decommissioning and dismantling policy in The 6th General Radioactive Waste Management Plan states that decommissioning and dismantling of nuclear facilities will be carried out to green-field conditions as soon as the plants are shut-down and when technologically feasible.

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 (500 MWe graphite gas reactor) was the first of this kind of activity, and facilitated ENRESA carrying out subsequent decommissioning tasks, like the ongoing decommissioning of José Cabrera NPP. The decommissioning and dismantling from Vandellós I NPP was approved by the Government in January 1998; that of José Cabrera NPP was granted in 2006.

The technical option selected for Vandellós I 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 the summer of 2003 when the period of safe enclosure started.

In the case of José Cabrera NPP decommissioning tasks started with the transfer of the spent to a temporary storage facility, this being an essential pre-requisite for dismantling. In 2006, the Ministry of Industry, Tourism and Trade authorized the licensee, to construct this auxiliary facility for the storage of this fuel. Following approval by the Nuclear Safety Council, Enresa initiated decommissioning work in 2010.

The schedule of activities covers the period 2010 to 2016. The tasks include the disassembly of equipment and systems, the dismantling of buildings, the disassembly of major components, decontamination tasks, the transfer of radioactive and conventional wastes and declassified materials, landfill and the environmental restoration of the site to “green field” conditions.

TRANSPORT

Spanish transport regulations are based on the International Atomic Energy Agency Regulations for the Safe Transport of Radioactive Materials. In addition, 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. 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. There has never been any noteworthy incident in the almost 3 million kilometers over which Enresa has transported materials.

COMPETENT AUTHORITIES AND IMPLEMENTING ORGANIZATION

Regulating and Licensing

By law, the Ministry of Industry, Energy and Tourism, is responsible for enforcing nuclear legislation and for granting licenses, this latter 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 the Parliament.

The Ministry of Agriculture, Food and Environment participates in the licensing process, in collaboration with the CSN, to jointly provide an environmental impact statement. This procedure takes into account regional and local governments in the areas under their competence.

The Nuclear Safety Council ([Consejo de Seguridad Nuclear](#), CSN), created by Law 15/1980 modified by law 33/2007, is the authority responsible for nuclear safety and radiological protection in Spain. It is an independent regulatory body which reports on its activities to the Parliament.

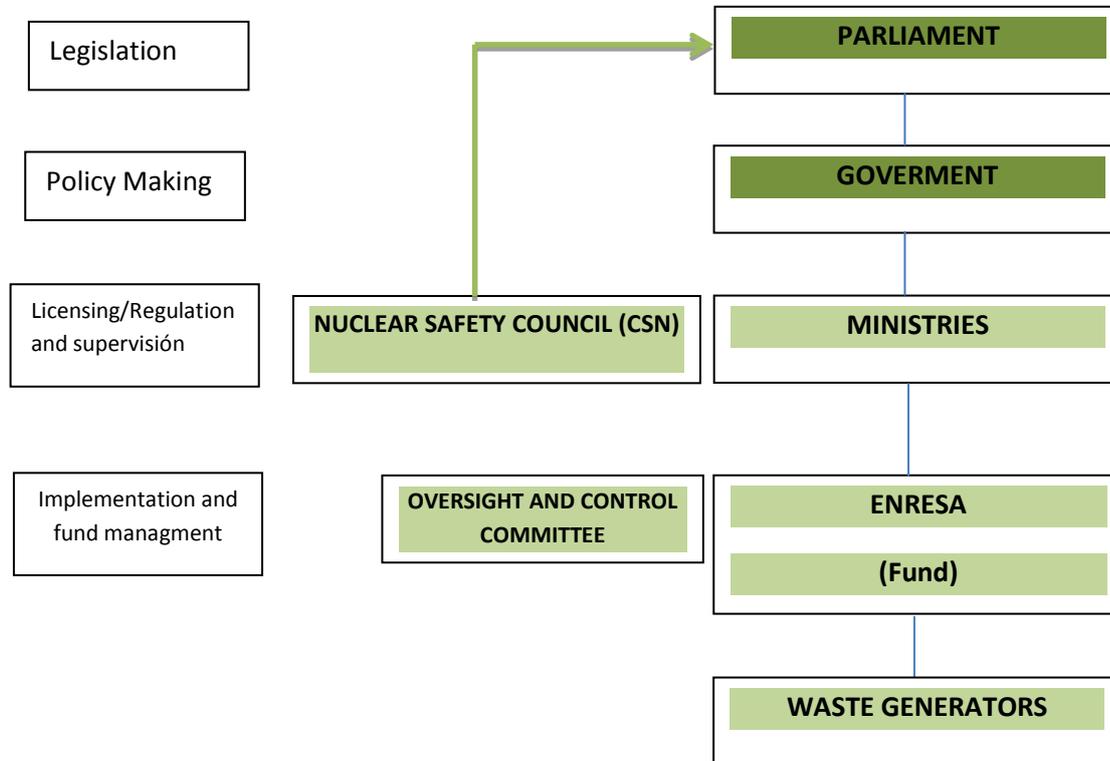
The CSN, among other functions, issues reports to the Ministry of Industry, Energy and Tourism on nuclear safety, radiological protection, and physical protection aspects, prior to the adoption of the resolutions that this body may approve on matters related to the award of authorizations for nuclear and radioactive installations, transport of nuclear substances or radioactive materials, the manufacture and official approval of pieces of equipment comprising radioactive sources or generating ionizing radiation, the exploitation, restoration or closure of uranium mines, and in general, all activities related to the manipulation, processing, storage and transportation of nuclear and radioactive substances.

Implementing organization

The Empresa Nacional de Residuos Radiactivos, 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 programs according to the policy and strategy approved by the Spanish Government, by way of the 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 centralized storage and disposal facilities;
- Setting up of necessary systems for collection, transfer and transport of radioactive wastes;
- Decommissioning and dismantling of nuclear installations when their service lifetime has come to an end and for the environmental restoration of the site;
- Conditioning of uranium mining and milling tailings when required;
- Support to civil protection services in cases of nuclear emergency;
- Establishment and coordination of R&D Plans;
- Management of the Nuclear Waste Fund.

MAIN BODIES INVOLVED IN RADIOACTIVE WASTE MANAGEMENT IN SPAIN



FINANCING

The management of radioactive waste, including spent nuclear fuel, and the dismantling and decommissioning of nuclear facilities, commissioned to ENRESA, are carried out with financing via the Fund for the financing of the activities included in the General Radioactive Waste Plan. The purpose of the fund is to cover all expenses incurred for the safe handling and disposal of spent nuclear fuel, as well as dismantling nuclear facilities and disposing of the decommissioning waste. The Fund is made up of the sums arising from the collection of fees to the waste producers as well as of any compensation or income arising from the rendering of the said services. Also integrated in the Fund is the yield on its transitory financial investments. Fees in the form of taxes are set legally by the Government.

The sums integrated into the Fund may be invested only in expenses, works, projects and assets deriving from the activities contemplated in the General Radioactive Waste Plan approved by the Government.

The Fund is managed by ENRESA but the supervision and control of the transitory investments relating to the financial management of the Fund correspond to a Tracking and Control Committee attached to the Ministry of Industry, Energy and Tourism through the Secretariat of State for Energy.

Costs estimations are also carried out by ENRESA who is required to submit to the Ministry of Industry, Energy and Tourism and Commerce a proposed revised version of the economic and financial projections and requirements necessary to carry out the activities stipulated in the General Radioactive Waste Plan when dealing with its revision every four years. Every year, ENRESA also updates its forecast of the income required.

PUBLIC INFORMATION

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

INSTITUTIONAL

MINISTRY OF INDUSTRY, ENERGY AND TOURISM (MINETUR)

Web site: www.minetur.es

REGULATOR AND SUPERVISOR

NUCLEAR SAFETY COUNCIL (CSN).

One of the functions attributed to the CSN is to keep the public opinion informed on matters of its competence, to the extent and with the periodicity that the Council determines, without prejudice to the publicity of its administrative actions, within the legally established terms.

Web site: www.csn.es

INDUSTRY

ENRESA

Information on radioactive waste management issues is provided by ENRESA, either in the visitor centers or through periodical publications, brochures, videos...Four visitors center are presently open, at ENRESA headquarters in Madrid, at the LILW Centralized Storage Center in El Cabril (Córdoba), Vandellós I plant (Tarragona) and at the José Cabrera NPP.

Website: www.enresa.es