

# **Radioactive Waste Generated from Spanish Nuclear Power Plants (NPPs) and Management of Radioactive Waste**

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# Parque nuclear español



STA. M<sup>a</sup> DE GAROÑA



ALMARAZ I Y II



TRILLO



JOSÉ CABRERA



ASCÓ I Y II



VANDELLÓS I



VANDELLÓS II



COFRENTES

- 7 Reactores en Operación
- 1 Reactor en cese de actividad
- 2 Reactores en Desmantelamiento

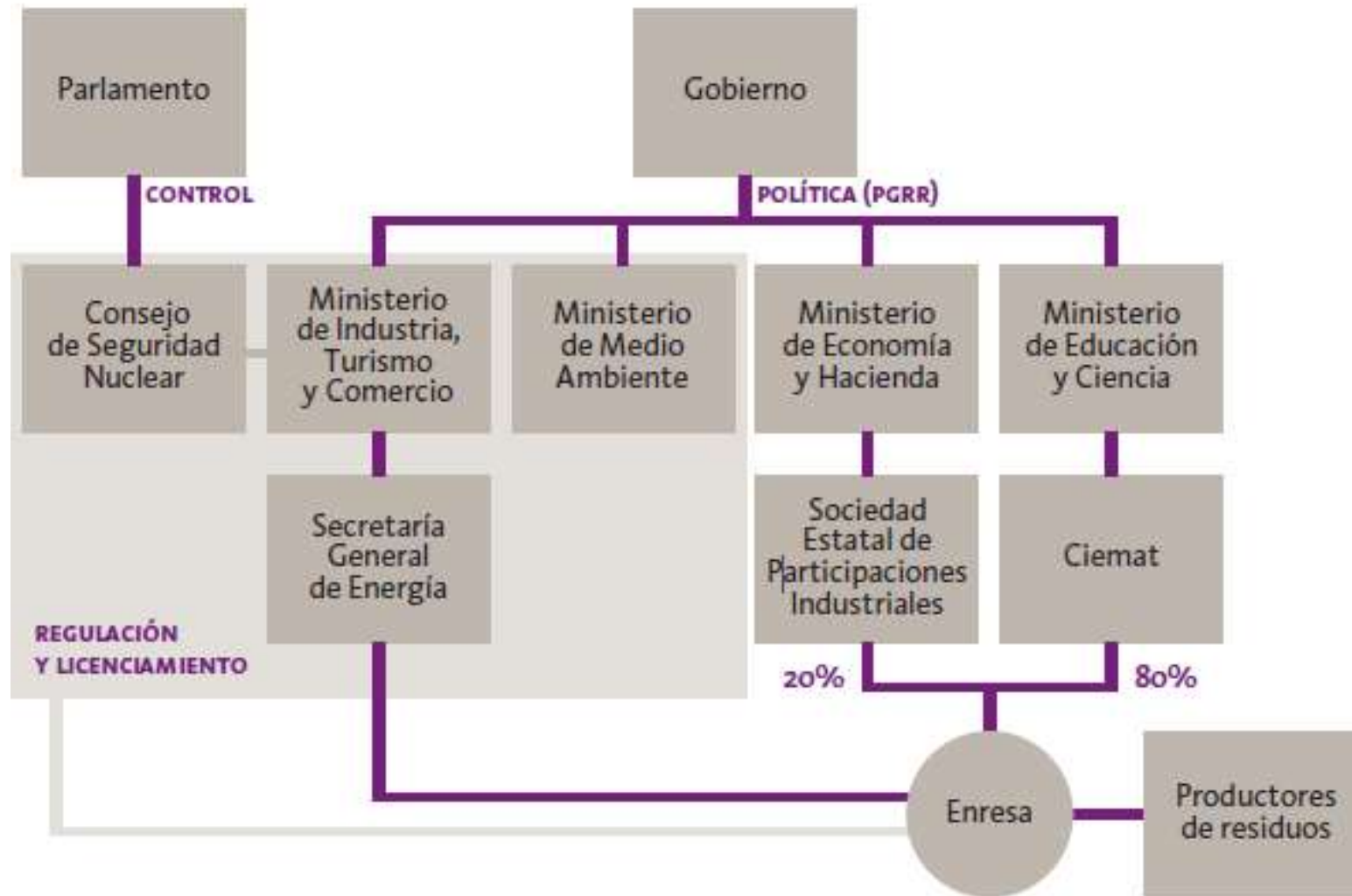


# ENRESA (Empresa Nacional de Residuos Radioactivos)

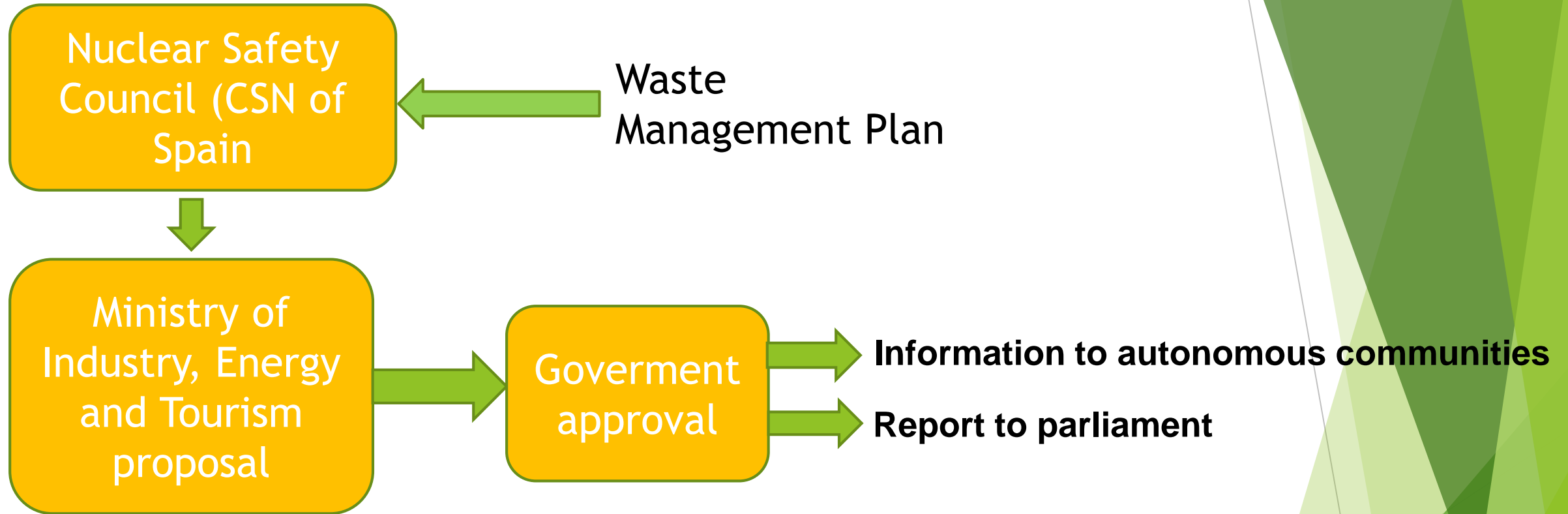
On 28/June/1984 Spanish parliament has approved to found the ENRESA and 4/July /1984 constitution was authorized by Spanish government with CIEMAT 80% and National Industri Instution (SEPI) 20% participations.

- ▶ **Establish systems for the collection, transfer and transportation of radioactive waste**
- ▶ **Gestionar las operaciones derivadas de la clausura de las instalaciones nucleares y radiactivas.**
- ▶ **Ensure the long-term management of any facility serving as storage of waste**
- ▶ **Cary out the necessary technical and financial-economic studies to determine the costs arising from the management of radioactive waste and establish the appropriate economic policy.**
- ▶ **Search for sites, design, build and operate centers for temporary and permanent storage of high, low and medium radioactivity residues**

# Administrative organization for Radioactive Waste in Spain



# Radioactive Waste Management Policy of Spain



- ▶ The plan will be reviewed periodically by taking account scientific and technical experience. Additionally, the preparation of the plan will promote public participation.
- ▶ At present, the current General Plan for Radioactive waste is the 6th PGRR since 2006. The first plant was approved, 1/10/1987.

# Financing of Radioactive Waste

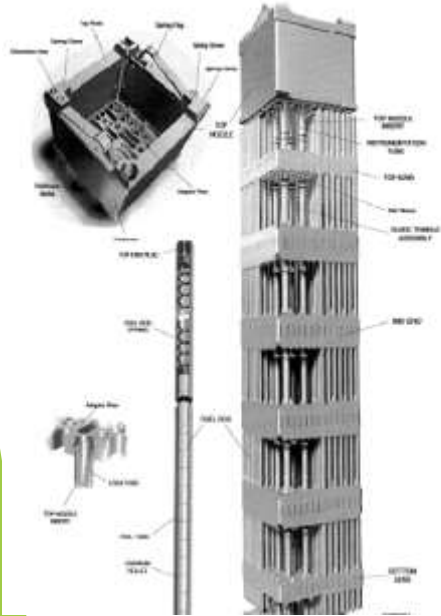
- ▶ Financing of the waste management of Spain was established in 1983 by setting a percentage share of the revenue from the sale of electricity throughout the electricity sector.
- ▶ The percentage quota will be reviewed annually.
- ▶ ENUSA has a special agreement through the value of producción of uranium and fuel assembly.
- ▶ Additionally, services carried out by Enresa to the other nuclear and radioactive facilities other than NPP, was included in a contract approved by the ministry of industry.
- ▶ In 2005, a new law was established by means of productivity and polluter-pays principle. This means that all the radioactive waste generated by NPP after 31/03/2005 should be paid to Enresa for their future management maintaining the financing through electric tariffs before 1/4/2005.
- ▶ Finally, in 2009 establishes a new system of financing by taxes, from 2010, whereby NPP must bear the costs of management of their radioactive waste and thereby freeing the electric tariff.

# General radioactive waste plan of Spain

## Spent fuel and High Activity Waste (HAW)

Spent fuel

HAW (from reprocessing)



called “special waste, RE”, neutrón sources, CR, plugs,.. their characteristics require specific facilities

## Intermediate and Low -Very Low Level Waste (EL CABRIL)

- They contain  $\beta$  -  $\gamma$  emitters with half - lives < 30 years,
- They do not generate heat and
- Concentration in emitters  $\alpha$  is very small.

They storage at El Cabril.

During the operation

During the dismantling

# El Cabril

- ▶ The first NPP, PWR, Westinghouse, 160MW, operation 1969-2006, Zorita NPP.
- ▶ In 1989 Enresa is authorized to construct the storage of Low and Intermediate Level radioactive waste in El Cabril, Cordoba.
  - 20 years operation period.
  - control and surveillance period 300years.
- ▶ In 2005. Enresa is authorized the construction of the facility of very low level waste at the El Cabril (control and surveillance period 60years) and since 2008 is in operation.
  - control and surveillance period 60 years.



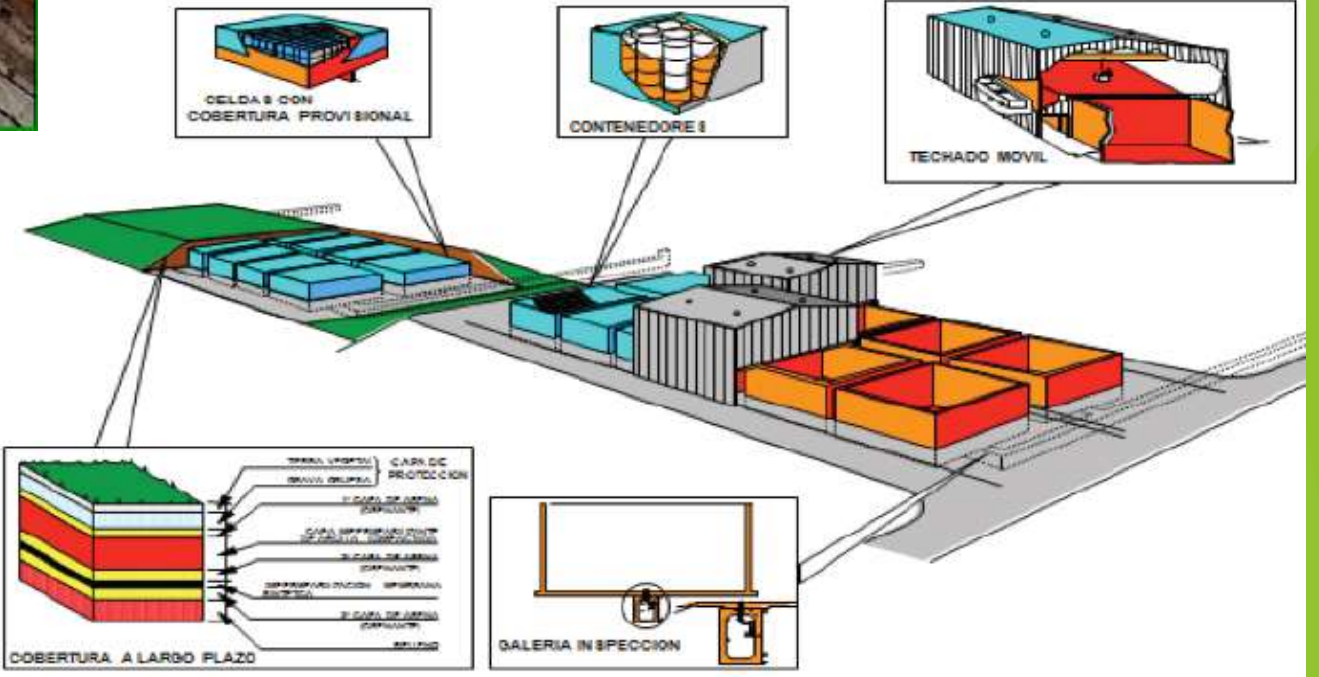




Compactadora



Incinerador



# Estimation of waste production in Spain after 40 years operation of NPPs

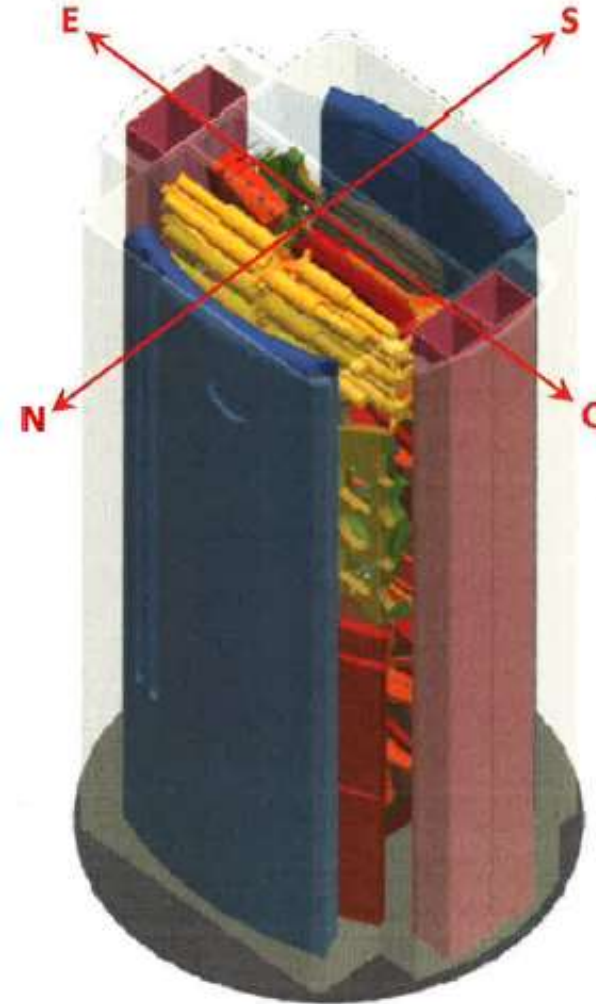
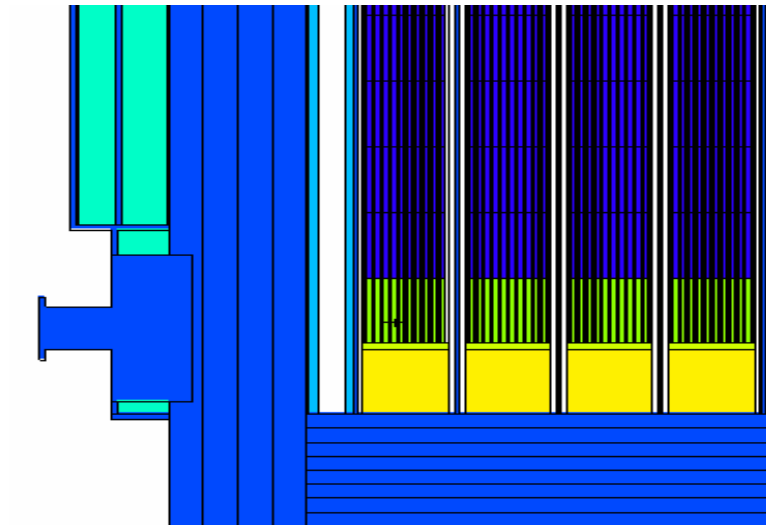
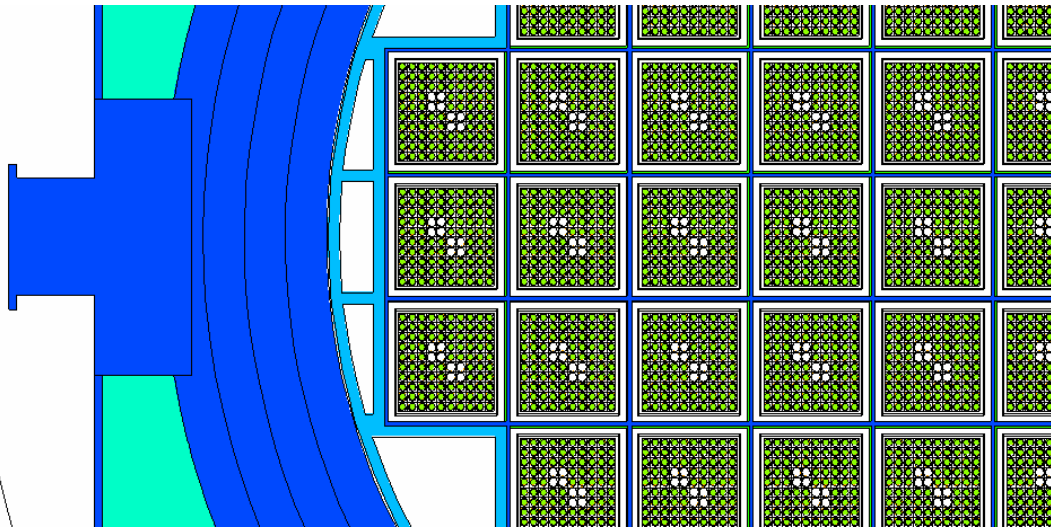


Cooling (Y)	Heat (W/SF)	Activity (TBq/SF)	Dosis (Sv/hr)
1	4800	105	2340
5	930	2-10 <sup>4</sup>	468
10	550	1.5-10 <sup>4</sup>	236
50	250	0.5-10 <sup>4</sup>	86

# Spent fuel and HAW from NPPs operation

Spent nuclear fuel pools and containers next to the NPPs

HAW from reprocecing of the nuclear fuels from Vandellos I, Zorita and Garoña are in France and England



# Present SF and HAW Management Plan in Spain



## Objetivos históricos:

- Proporcionar suficiente capacidad para apoyar la operación de las CCNN mientras se busca solución para Almacenamiento Prolongado
- Buscar soluciones para Almacenamiento Definitivo

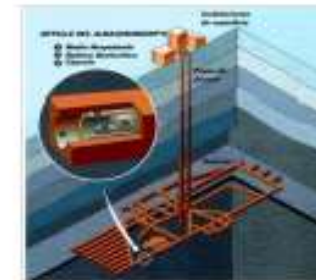
1.- Reracking  
90's



2.- ATI  
2000-2016



3.- ATC  
2018-2077



4.- AGP  
2068-



# Storage next to NPPs site



- **Sistema ENUN52B**
  - Doble Propósito: Almacenamiento y Transporte
- **Capacidad: 52 EECC BWR**
- **Peso cargado: 71 t** (limitada por grúa CN Garoña)
- **Estado actual:**
  - Licenciado para almacenamiento y transporte para contenidos limitados (posible extensión)
  - En fabricación.

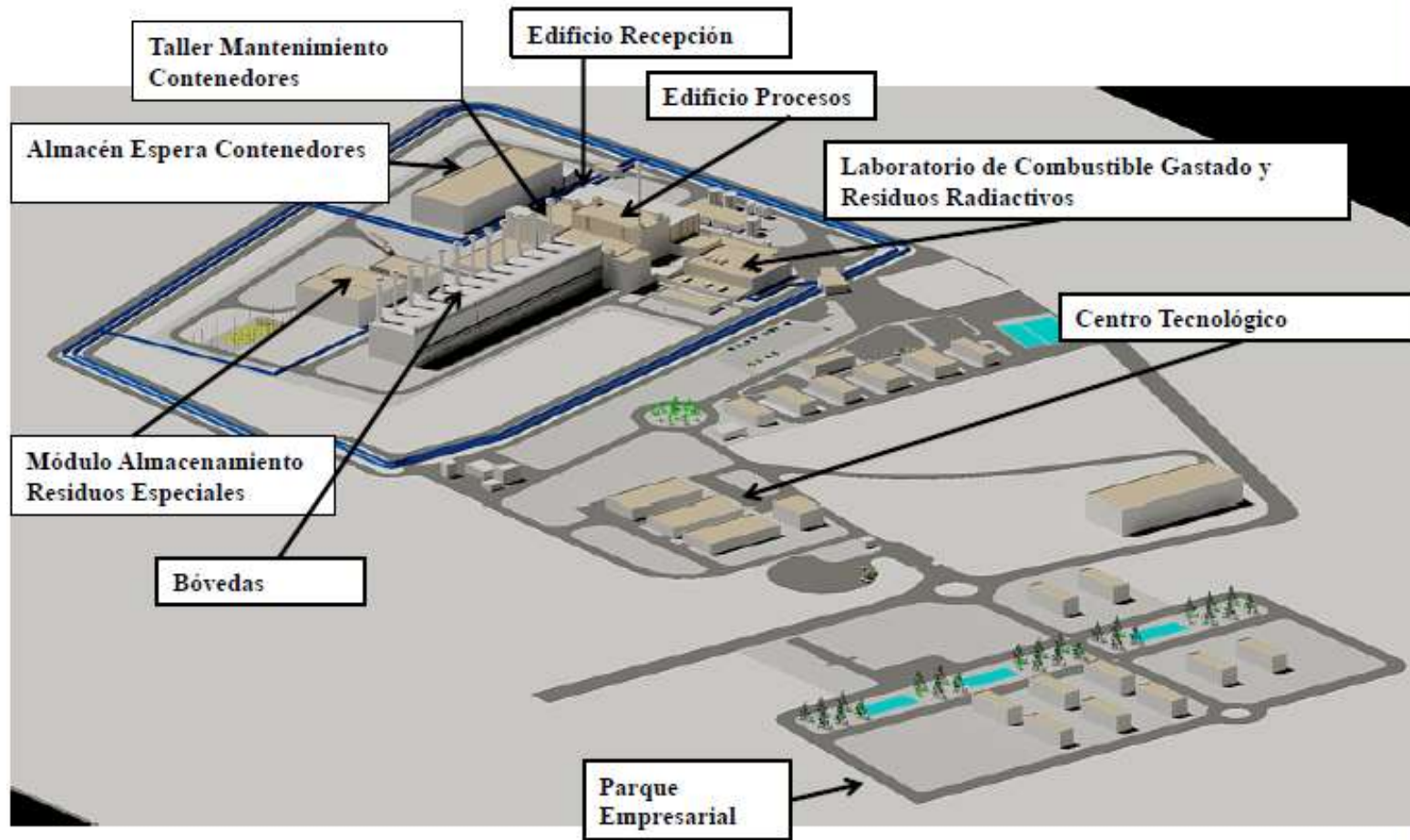


# Central Storage Site for SF and HAW, in Cuenca

-1000Milion  
Euro

-300-500  
workers  
during  
construcción

-150  
workers  
during  
operation



# Storage type (Boveda)

## ALMACENAMIENTO DE LOS VIDRIOS



# Management of HAW and SNF policy in Spain

- ▶ (2013-2020) actualization of the knowlage
- ▶ (2020-2023) Evaluation of goverment
- ▶ (2023-2027) Selection of site for Deep geologic disposal, candidates
- ▶ (2028-2035) Technical analilies for site selection
- ▶ (2036-2050) Detail characterization of the site and underground lab.
- ▶ (2051-2063) Licencing and constructor disposal
- ▶ (2063-2068) Initial operation
- ▶ (2069-) operation normal

