

**ISSF 2010**

# **Spent Nuclear Fuel Management in Spain**

**Pablo Zuloaga, Javier Fernandez**

## Introduction

- **Ministry of Industry, Tourism and Commerce**
  - Radioactive waste, decommissioning and NSF management policy
    - *Cabinet approved “ 6th Radioactive Waste General Plan” 2006*
  - Grants Licenses of Nuclear Installations
- **Nuclear Safety Council**
  - Independent from the Government
    - *Nuclear safety and radiological protection regulation and guidance*
    - *Evaluation and reporting previously to Licenses*
    - *Inspection and enforcement*
- **ENRESA**
  - Management of spent fuel and radioactive waste
  - Nuclear installations decommissioning as well
- **NPP / Utilities**
  - Operate on site storage
  - Deliver the SF and waste packages in accordance to WAC
  - Pay the costs through fees on nuclear energy generation

## NPP location and NSF situation

- **10 Nuclear Power Reactors**
- **8 reactors in operation in 6 sites**
  - 7.8 GWe
  - 19% of country's electricity generation
- **2 NPP shut down, being decommissioned**



## NSF and HLW-MLW Inventory and estimates

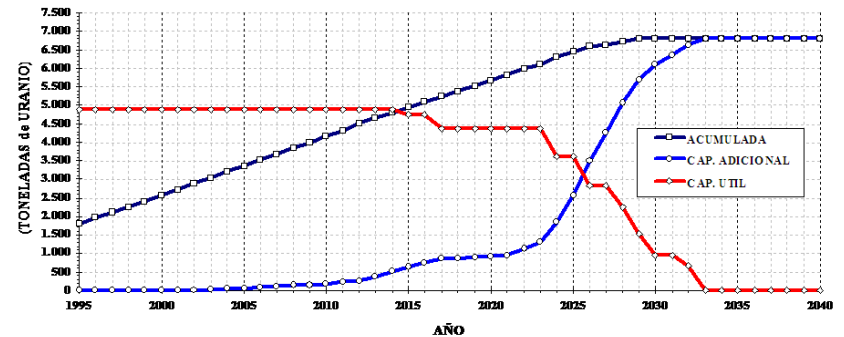
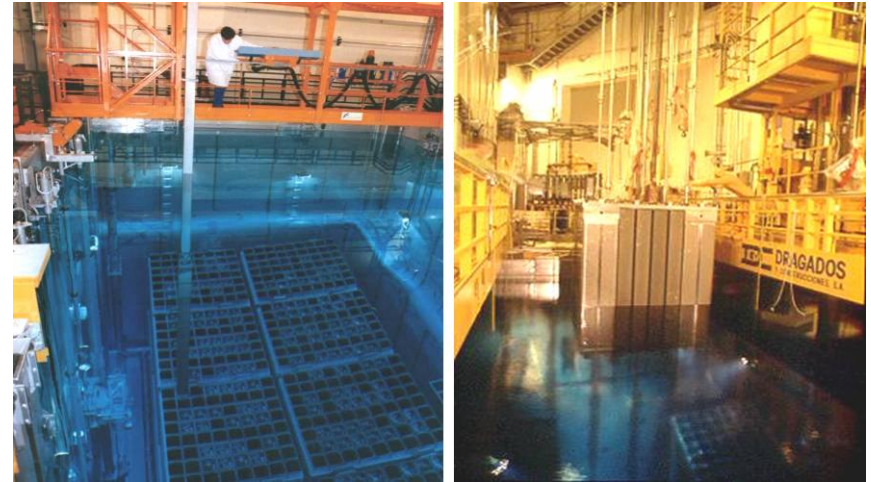
- **Present Inventory**
  - 4000 tU SF in storage (December 2009)
    - *Most of it in pools*
    - *2 ISFSI in operation (dry-storage)*
      - Trillo NPP → dual purpose metal casks indoor
      - Jose Cabrera NPP → concrete casks on a pad outdoors
      - Ascó NPP is in the licensing process for another ISFSI → similar to Jose Cabrera ISFSI
- **Total amount of Spent fuel considered**
  - 20000 Fuel elements
  - 6700 tU
- **HLW and MLW management**
  - HLW (vitrified waste canisters)
  - Medium Level (long-lived) waste packages
    - *Around 650 m3 from reprocessing*
    - *Around 1000 m3 to be generated in decommissioning reactor internals*

## General aspects of NSF management

- **The priority is the Centralized Interim Storage Facility (ATC)**
  - Complemented by In situ Increased Storage capacity when required
- **Deep Geological Disposal studies continuation to support decision making about management options**
- **Other options also studied: advanced cycles**
- **R&D Plan 2009-2013**
- **Costs supported by the NPPs as a fee on nuclear electricity gross production**
- **Direct disposal considered as an assumption for financing the waste management fund**

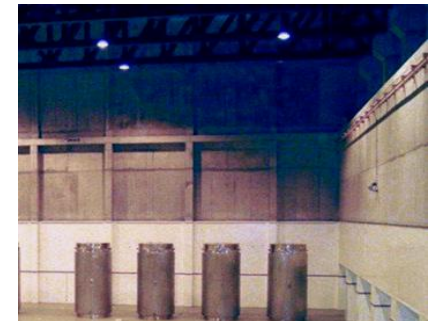
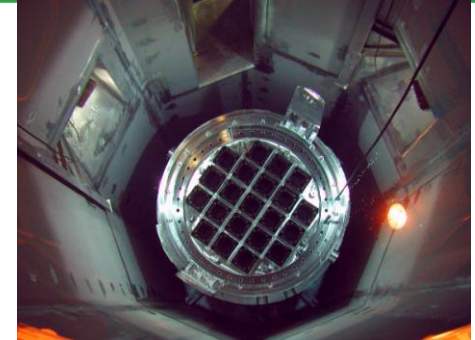
## In situ storage capacity increase

- **Re-racking of all NPP's in previous actuaciones**
- **Second re-racking of Cofrentes NPP in 2009**
- **Dry storage at Trillo NPP**
  - ENSA DPT Dual purpose casks
- **Dry storage at Jose Cabrera NPP**
  - HI STORM system
  - Total fuel inventory
- **Dry storage at Ascó NPP**
  - HI STORM system
  - Number of casks will depend on ATC Commissioning



## Independent SF storage Facility at Trillo NPP

- **Agreement between ENRESA and Utility**
  - ENRESA licensed the system
  - Trillo NPP licensed the facility as part of the NPP
- **Storage Casks System**
  - Dual purpose metal casks. ENSA DPT
  - 21 fuel elements per cask
  - Non encapsulated
  - Re-licensed from 45 to 49 GWd/tU
- **ISFSI Commissioned in 2002**
  - Dedicated building to meet NPP dose rate design criteria
    - *Capacity for 80 casks*
  - 18 casks stored
    - *378 fuel assemblies*





## Independent SF storage facility at Jose Cabrera NPP

- **Similar scheme as in Trillo NPP**
  - Agreement ENRESA-Utility
- **HI STORM system**
  - MPC Multipurpose canisters
  - Shielding modules HI STORM
  - Transfer cask HI TRAC
  - Transport cask HI STAR
- **Storage pad for 12 modules + 4 modules for Decommissioning wastes**
- **100% fuel inventory transferred**
  - 377 fuel assemblies (100.5 tU)





## ATC. The Centralized SNF and HLW storage facility project

- **Defined as a priority in the 6th General radioactive Waste Plan**
- **Parliament supported:**
  - In 2004, Industry Commission of the Parliament unanimously asked the Government to develop ATC facility
  - In 2006, the Parliament urged the Government to set an Inter-Ministerial Commission to lead the site selection process
- **Site selection process in progress.**
  - Launched in December 2009 with a decree establishing minimum criteria and how to proceed.
  - Technical report released in September 2010 pre-characterizing the eight (8) final candidates' sites:
    - *Meteorology*
    - *Geology*
    - *Communications and logistics*
    - *Social issues: economic impact, social acceptance, etc.*
    - ...

## ATC. The Centralized SNF and HLW storage facility project

- **Advantages:**
  - Unification of SF management
  - Independence between short-term and long-term management
  - Flexibility
  - Minimization of the total number of nuclear installations
  - Efficiency for reaching safety and security levels
  - Possibility to release decommissioned nuclear sites
  - Respect of international engagements
  - Cost reduction
  - Optimization of support services and operations

## ATC. The Centralized SNF and HLW storage facility. Main parts

- **Three main parts**
- **The Centralized Interim Storage Facility (ATC) itself**
  - Unloading and encapsulation
  - SF/HLW storage
  - MLW storage
- **A Research Center**
  - Spent fuel and waste laboratory
  - Other laboratories (chemistry and environment, materials, prototypes...)
- **A Business park**
  - Regional development project
  - Infrastructure for companies settlement in the area

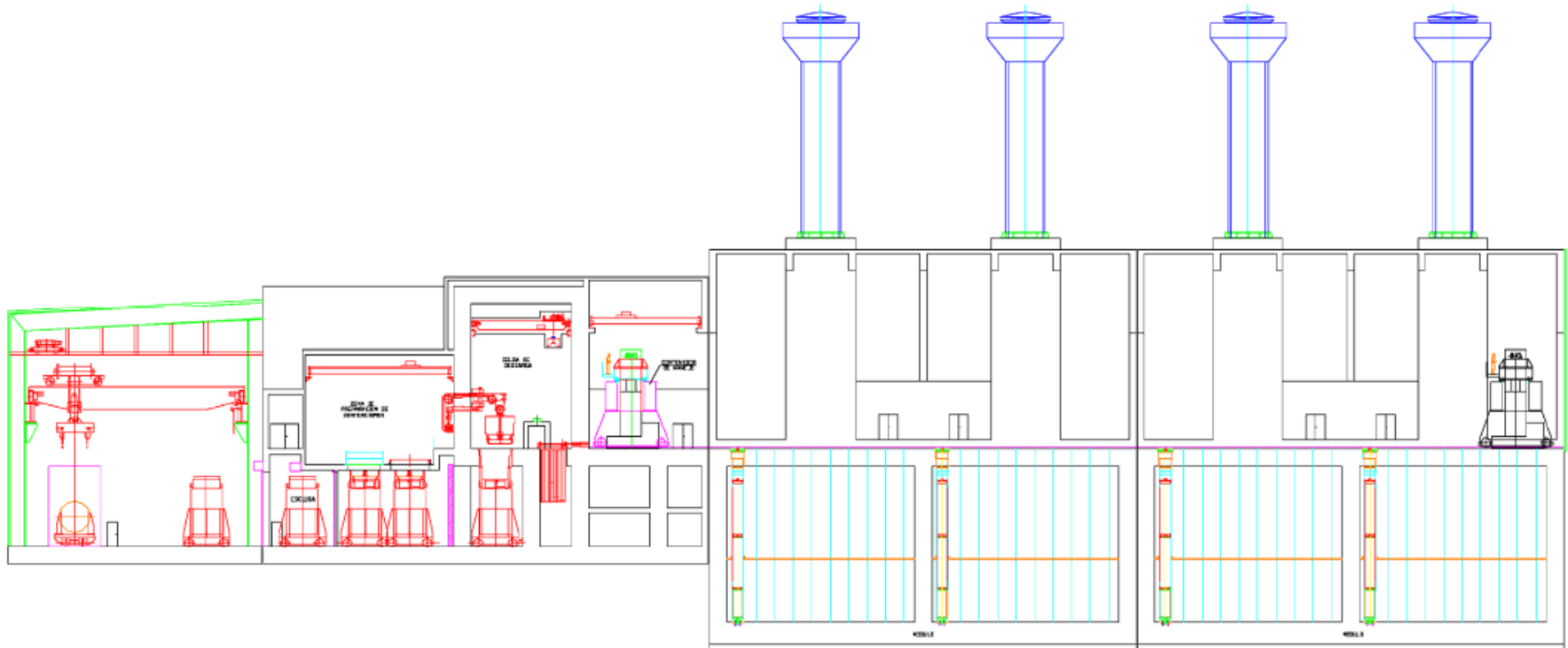


## ATC. The Centralized SNF and HLW storage facility. Site selection process

- **Siting based on volunteer candidate municipalities:**
  - Principles of publicity, participation and transparency.
  - Volunteer municipalities: candidature approved by the Local Council
- **Creation of an inter-ministerial Commission to:**
  - Defining the technical and social criteria for municipalities candidate to host the facility
  - Supervising the respect to the siting process criteria
  - Managing the information and candidatures reception
  - Assessing and Proposing to the Government suitable sites in candidate municipalities
- **Information campaign 2006-2008**
- **Call for candidate municipalities in December 2009**
  - Excluded areas report published in April 2009. Site proposal
  - Potential sites in eight municipalities are being studied
- **Pre-characterization of sites released in September 2010**
- **The Government will decide the site**
  - Dialog with the suitable candidate local councils
  - Dialog with Region Government

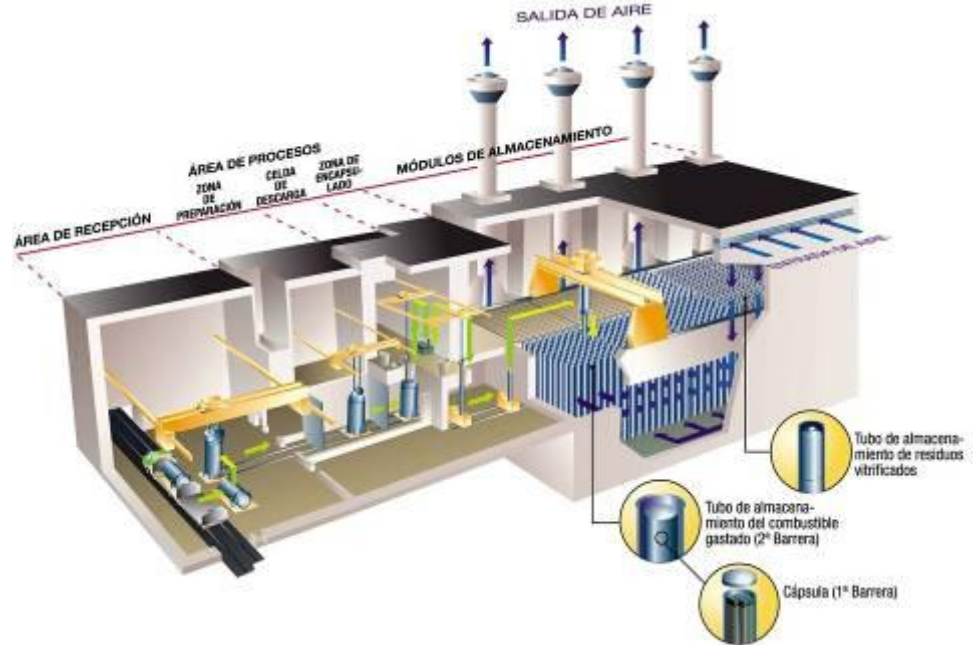
## ATC. The Centralized SNF and HLW storage facility. Functions

- **The ATC facility is designed for the following functions:**
  - Reception and unloading.
  - Encapsulation of fuel assemblies.
  - Long-term Storage of SNF and waste packages
  - Retrieval of waste packages for future management options.



## ATC. The Centralized SNF and HLW storage facility. Conceptual design

- **Vault type:**
  - Spent Fuel and HLW encapsulated in canisters
  - Canisters placed in storage dry wells
    - *Double barrier*
    - *Inert atmosphere*
  - Cooling by natural draft
- **Storage bunker for MLW (long lived)**



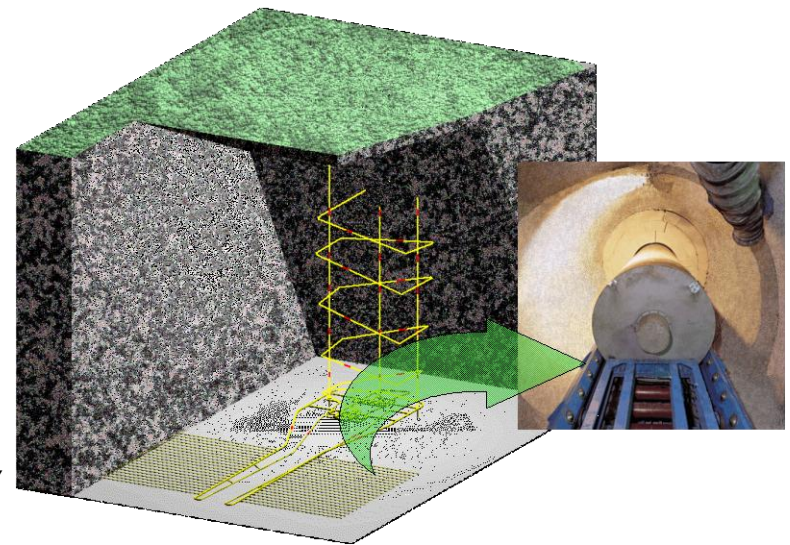
## ATC. The Centralized SNF and HLW storage facility. Focus

- **Detailed revision of expected inventories and acceptance criteria, with particular attention to**
  - Trend to higher burn-ups
  - Final cycles with relatively low cooling periods
  - Fuel characterization status and requirements
- **SF and waste laboratory**
  - SF characterization and behaviour
    - *Extended storage*
    - *Disposal*
    - *Mechanical, chemical, and radiological characterization and behaviour of Rods, samples, irradiated materials*
- **Launching characterization and licensing work after site designation**



## Deep Geological Disposal. Previous works

- **Site identification Program: 1986-1996**
- **Deep Geological Repository design and associated Performance assessment (1990-2004) in three steps:**
  - Disposal concept and basic design
    - *Carbon steel canisters placed horizontally in parallel galleries, with Calcium-Bentonite seal*
  - Strengthening the bases of the concept
    - *Flexibility and Robustness (better justification of decisions, alternatives analysis)*
    - *Convergence: Package definition common for the three host rocks in consideration (salt, clay and granite)*
  - Optimization through requirements review



## Deep Geological Disposal. Supporting Research

- **Priority of HLW/SNF management is interim storage**
- **DGR in 2050 for planning and financial purposes**
- **R&D supporting Deep Geological Repository development adapted to planning.**
- **Main objectives:**
  - Respect of International Commitments and Co-operation
  - Maintenance of research groups' Capabilities
  - Follow-up of state of the art
  - Support future decisions
  - Focus on techniques and basic aspects
  - Consideration of alternatives (i.e. separation and transmutation) and their influence in DGR concept

## Conclusions

- **ATC. The priority**
  - Gives time for decision making depending on trends and technological and social advances
  - The Government has launched the call for candidate municipalities to host the Central SNF/HLW Interim Storages in December 2009.
  - Site analysis to be completed in June
  - The Ad-hoc Inter-ministerial Commission will pass a report with site proposals
  - Technical report pre-characterizing sites released in September 2010
  - The CSN approved the generic design of such facility
- **NPP on site storage capacity increase as needed**
- **Research includes extended storage conditions. Research on geological disposal and on advanced recycling options continue in a scale adapted to the general waste management plan time frame.**
- **Reports to the Government on**
  - Generic Design of Deep Geological Disposal,
  - Management options and
  - Feasibility of advanced separation and transmutation

- **Thank you for your attention**