Spanish strategy for the management of Spent Nuclear Fuel – ATC Project

IAEA, Vienna, June 2015
• Nuclear Energy in Spain Overview
• SNF& HLW Management Policy
• Interim Storage at Reactor Sites
• Centralized Interim Storage – ATC Project
• Challenges and Discussion
• Conclusions
10 Nuclear Power Reactors:
- 7 in operation in 5 sites
- 1 shutdown in standby
- 1 in D&D
- 1 dismantled (latency period)

Energy demand coverage 2014

Nuclear Energy:
- 7.7% of installed power (7.39 GWe) in 2014
- 21.9% of energy production in 2014
Spanish strategy for the SNF mgmt. – ATC Project

### SNF Inventories

<table>
<thead>
<tr>
<th>SNF (UO₂)</th>
<th>Type</th>
<th>Storage</th>
<th>Current Inventory (FA (tU))</th>
<th>Total Estimates (FA (tU))</th>
</tr>
</thead>
<tbody>
<tr>
<td>PWR</td>
<td>Wet</td>
<td>6696 (3075)</td>
<td>11395 (5136)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dry</td>
<td>1125 (450)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BWR</td>
<td>Wet</td>
<td>6485 (1163)</td>
<td>8389 (1504)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dry</td>
<td>--</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td>14306 (4688)</td>
<td>19784 (6640)</td>
<td></td>
</tr>
</tbody>
</table>

(1) As of 31 December 2014.
(2) Burnup up to 60 GW/tU
(3) For 40 y of operation

<table>
<thead>
<tr>
<th>Type</th>
<th>Total Amount (m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HLW</td>
<td></td>
</tr>
<tr>
<td>Canister CSD-V</td>
<td>68 (12)</td>
</tr>
<tr>
<td>ILW-LL (Special Waste)</td>
<td></td>
</tr>
<tr>
<td>Canister CSD-B</td>
<td>12 (2,14)</td>
</tr>
<tr>
<td>Canister CSD-C</td>
<td>12 (2,22)</td>
</tr>
<tr>
<td>Waste from reactor dismantling(4)</td>
<td>~430 m³</td>
</tr>
</tbody>
</table>

(4) Package type in definition.
(5) GTCC waste in USA terminology
The Spanish Government is responsible for establishing the Policy on Radioactive Waste Management and Radioactive and Nuclear Installations D&D

- Revision: Every 4 y or per MINETUR request
- ENRESA elaborates and sends it to MINETUR
- Information
  Published at [www.enresa.es](http://www.enresa.es) (in Spanish and English)

Cabinet of Ministries approval

**CONTENT**
- Strategy
- Actions
- Technical solutions
- Financial and Economical Forecasts

**HORIZON**
- Short
- Medium
- Long Term
SNF AND HLW MANAGEMENT POLICY – 6th GRWP

- Different options assessed according Spanish Nuclear Program Size
  - Deep Geological Disposal preferred
    - Needs ample societal and technical development
    - Interim storage in the meantime
      - It allows R&D to provide solutions to future decisions: confirming geological disposal or even coming back to recycling if advanced cycles are industrially deployed.
      - Centralized solution preferred with ad-hoc facilities when needed

- Conclusions:
  - 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. Considered as an assumption for financing the Waste Fund.
  - Costs supported by the NPPs as a fee on nuclear electricity gross production
Through agreements with NPPs owners:

- **Pools**
  - *Reracking performed in all NPPs*

- **Dry systems**
  - **ENRESA: Licensing and supply of transport and storage systems**
    - Through international call for bids
  - **Utilities: ISFSI licensed as a design modification of the NPP**

- ISFSIs at Trillo, Jose Cabrera and Ascó NPPs
- Waste Management Plan for Garoña NPP (ISFSI being built after summer 2015)

- ENRESA is the nuclear operator of Jose Cabrera ISFSI as responsible for the D&D of the whole facility
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At Reactor Storage Facilities

DRY STORAGE AT REACTOR SITES (IN OPERATION)

TRILLO

Dry storage at Trillo NPP

- DPT dual purpose cask (21FA)
- Relicensed up to 49 GW/tU
- Capacity: 80 casks
- Commissioned in 2002
- 28 casks (588 FA)

José Cabrera

Dry storage at José Cabrera NPP

- HI-STORM 100 / HI-STAR (canister-based system)
- Licensed for transport up to 45 GW/tU
- Capacity: 16 casks (4 for SW)
- Commissioned: 2009
- 12 casks with 377 FA

Ascó

Dry storage at Ascó NPP

- HI-STORM 100 / HI-STAR (canister-based system)
- Licensed for transport up to 45 GW/tU - for storage up to 55 GWd/tU
- Capacity: 32 casks
- Commissioned: 2013
- 5 casks with 160 FA
DRY STORAGE AT REACTOR SITES (IN CONSTRUCTION)

NEW DRY STORAGE FACILITY
SANTA Mª DE GAROÑA NPP

- ENSA’s ENUN52B dual purpose cask
  - Design approval for storage granted in November 2014.
  - Design approval for transport granted in May 2015.
  - Limited contents (low burnup fuel, high cooling times)
- ISFSI licensed in February 2015 by the Plant owner. Construction permit expected soon.
  - 2 x 16 position pads at the open-air
  - First loading 2016. Uncertainties due to NPP situation on the restart of reactor operation.
The Project consists of three main elements:

- The storage facility itself
- A technological research center
- A business park
Siting Process

- 6th General Radioactive Waste Plan: Defined ATC as a priority

- Parliament supported:
  - In 2004, the Industry Commission of the Parliament unanimously asked the Government to develop an ATC facility
  - In 2006, the Parliament urged the Government to set up an Inter-Ministerial Commission to lead the site selection process

- COWAM recommendations

- Site selection
  - Launched in December 2009 with a decree establishing the minimum criteria and how to proceed.
  - Technical report released in September 2010 pre-characterizing the eight (8) final candidates’ sites and providing proposal a candidate sites to the Cabinet
Siting Process - Candidates
Siting Process
• **Characterization of the site** to provide the regulator (CSN) and the MINETUR with the documentation needed to issue the Preliminary Permit according to the RINR [7].

• Going further into the **detail design** of the facility to provide the regulator (CSN) and the MINETUR with the documentation needed to issue the Construction Permit of the facility according to the RINR [7].
  
  • **The Preliminary Safety Assessment Report (PSAR)** and other documents were presented in January 2014. Rev. 1 of PSAR including answers to RIAs expected in June 2015.

• **Environmental Impact Assessment** to provide the MAGRAMA with the documentation to issue the Environmental Impact Statement.

• Documentation needed to **change land use** from rural land to industrial use, according to local and regional regulation.

• Establishing a **preliminary logistics planning**.

• Providing information to stakeholders: **ENRESA Information Center** established in Villar de Cañas.
**Technology:**

- Dry storage of SNF and vitrified wastes in vaults
- Storage of ILW-LL waste (SW) on canisters at pits in a concrete building
- Temporary Loaded Cask Building
- Application for 60 years (design life: 100 years).

**Technical regulatory framework:**

- Spanish Nuclear Safety Council Instructions, Supplementary Technical Instructions, Safety Guides,…
- US NRC 10 CFR 72, NUREG-1567, SFST-ISGs, Regulatory Guides,…
- IAEA Safety Standards
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ATC Project – Main Process
Loaded Cask building

SW Storage building
- **ATC:**
  - Very tight schedule for designing, licensing, construction, testing, and commissioning the Facility.
  - Proposed early operation of the Loaded Cask Storage Facility to provide flexibility.

- **Technical issues:**
  - Regulation based on NPPs + Fukushima + 9/11
  - “Zero-liquid-effluent” policy
  - Unloading cell atmosphere:
    - Failed cladding fuel
    - Fuel handling issues
    - Crud deposition
  - Remote operations – Harsh conditions

- **Transportation:**
  - Low and High Burnup Spent Fuel Transportation from the NPP to the ATC (HBU: “case by case”)

- **With NPPs:**
  - Characterization and Classification of SNF (damaged/undamaged)
  - Fuel Acceptance Procedures
The priority of the Spanish SNF management is the Centralized Interim Storage Facility (ATC)
- Site selected December 2011
- Casks Storage Building to be commissioned earlier (mid-2017) than Main Process

Completed by In situ Increased Storage capacity when required
- ISFSI

Direct disposal considered as the basic assumption.

R&D plan
- Support to SF/HLW acceptance and characterization: performance-oriented, Long term storage, Ageing management, etc.
- Support to decision makers on further steps of SNF & HLW Management. ATC provides time for decisions. Hot Laboratory assist R&D on SNF & HLW.
Thank you for your attention
Questions?