Spanish Regulatory Approach for Dual Purpose Casks for Spent Nuclear Fuel

Fernando Zamora  
Transport Department  
Consejo de Seguridad Nuclear (CSN)

Manuel García  
Transport Department  
Consejo de Seguridad Nuclear (CSN)

Carmen Ruíz  
High Level Waste Department  
Consejo de Seguridad Nuclear (CSN)

Gregorio Orozco  
High Level Waste Department  
Consejo de Seguridad Nuclear (CSN)
• Spent fuel management strategy in Spain
• Licensing process of a Dual Purpose Cask
• Spanish Regulatory Requirements vs. TECDOC
• Conclusions
3 SPENT FUEL MANAGEMENT STRATEGY: PRESENT AND MEDIUM TERM

SPENT FUEL POOL

INTERIM STORAGE FACILITY AT NPP SITE

CENTRALIZED STORAGE FACILITY

MEDIUM TERM (2018-...)

PRESENT

Expected Storage Time for Spent Fuel in dry casks

Low Burnup Spent Fuel < 18 years
High Burnup Spent Fuel < 12 years
4 SPENT FUEL DRY CASK STORAGE FACILITIES -MAY 2014

- **Operating prevision:** 2015

  - Sª Mª Garoña NPP

- **Operating since:** 2002
  - Capacity: 80 casks
  - Spent Fuel Elements stored: 525 (25 casks)

- **Operating since:** 2013
  - Capacity: 32 casks
  - Spent Fuel Elements stored: 150 (5 casks)

- **Operating since:** 2009
  - Capacity: 12 SF casks+4 RW casks
  - Spent Fuel Elements stored: 377 (12 casks)

- **Operating prevision:** 2018
  - Vault type/ Casks reception Storage

- **Estimated:** 14000 Spent fuel elements are stored
- **1062** Spent Fuel Elements in Dry Casks

International Workshop on the Development and Application for a Safety Case for Dual Purpose Casks for Spent Nuclear Fuel

Vienna, 19-21 May 2014
# USED AND PLANNED DRY CASK MODELS

<table>
<thead>
<tr>
<th>MODEL</th>
<th>FUEL TYPE</th>
<th>PURPOSE</th>
<th>NPP</th>
</tr>
</thead>
<tbody>
<tr>
<td>DUAL PURPOSE CASKS</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ENSA-DPT</td>
<td>PWR-KWU 16x16</td>
<td>DPC</td>
<td>TRILLO NPP (operation)</td>
</tr>
<tr>
<td>ENUN-32P</td>
<td>PWR-W 17x17</td>
<td>DPC</td>
<td>GENERIC</td>
</tr>
<tr>
<td></td>
<td>PWR-KWU 16x16</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ENUN-52B</td>
<td>BWR-GE6 &amp; GE7 8x8 type1</td>
<td>DPC</td>
<td>Sª Mª GAROÑA NPP (operation)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HI-STORM Z</td>
<td>PWR-W 14x14</td>
<td>STORAGE 2002-22</td>
<td>J. CABRERA NPP (decommissioning)</td>
</tr>
<tr>
<td>HI-STORM</td>
<td>PWR-W 17x17</td>
<td>STORAGE 2010-2030</td>
<td>ASCO NPP (operation)</td>
</tr>
<tr>
<td>HI-SAFE</td>
<td>High Level Waste (core Internals)</td>
<td>STORAGE</td>
<td>J. CABRERA NPP (decommissioning)</td>
</tr>
<tr>
<td>HI-STAR 100</td>
<td>PWR-W 14X14 &amp; 17X17</td>
<td>TRANSPORT (REV.1) 2012-17</td>
<td>Valid for:</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• HI-STORM</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• HI-STORM Z</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• HI-SAFE (on evaluation)</td>
</tr>
</tbody>
</table>

**STORAGE AND TRANSPORT SYSTEMS**
International Conventions or Agreements ratified by Spain

Laws and statutory provisions

Standards with regulatory status

Binding records and decisions of the Administration

Non-Binding documents

International Conventions or Agreements ratified by Spain

Joint Convention on the safety of spent fuel management

European Agreement Dangerous Goods by road (ADR) (*)

European Directives

Law 25/1964 on Nuclear Energy
Law 15/1980 Creating the Nuclear Safety Council

Regulation on nuclear and Radioactive Facilities (RINR)
Regulation on the Protection of Health against Ionizing Radiations (RPSRI)
RD 102/2014 Safety management of Spent fuel

Safety Instructions: IS-20 (Cask), IS-26 (NPP) & IS-29 (S. facility)

Safety Instruction: IS-35 (Design Modifications)

Approval Certificates and Licenses: Conditions

Safety Guides:
- GS 9.03 (Control of spent fuel and RW management at NPPs)

Safety Guides:
- GS 6.04 (Application)
- GS 6.01 (Quality Assurance)

(*) There are also agreements for RID, IMDG and TI - ICAO
DPC LICENSING PROCESS

For Storage -> Design approval -> Use

For Transport -> Transport Approval

Storage Facility Approval

Pictures: courtesy ENSA
Both storage and transport design approvals are required.

The same specialists evaluate both storage and transport safety cases.

Increase the harmonization.
APPROVAL AND RENEWAL PROCESS ISSUES FOR DPC (1/2)

• DPC are required to comply with storage and transport requirements.

• **Storage and transport interface:** for the design of storage casks it is required a compatibility and interdependence with the design criteria for transport, in accordance with the regulation in force in this area (IS-20 paragraph 3.1.13).

• **Differences in Approval term:**
  - **STORAGE:** 20 years (IS-20)
  - **TRANSPORT:** ~ 5 years

• **Operational phase:** regulated by IS-20 (storage cask) and IS 29 (storage facilities), controlled by CSN evaluations and inspections, and the compliment of the approval conditions:

  ➢ *Manufacturing control* → Requirement for a control by an accredited body (Third Part Inspection)
  
  ➢ *Pre-loading report* → compliance with storage & transport requirements
  
  ➢ *Record Management* → Records of each cask shall be appropriately transferred during its life, with its manufacturing documentation and operational history *(IS-20)*
  
  ➢ *Annual Report* → Notification and evaluation of Operational Experience
  
  ➢ *Request for a Transport Approval* → Pre-transport inspection results analysis.
10 APPROVAL AND RENEWAL PROCESS ISSUES FOR DPC (2/2)

• **Interface between stake-holders (NPP-Storage Facility-RadWas Management Company)** There is only one agency (ENRESA) in charge of the spent fuel management in Spain.

• **Design modifications**
  • Regulated by Safety Instructions: IS-20 (storage casks) and IS-35 (transport casks)

• **Renewal process:**
  • IS-20 (storage casks, paragraphs 5.1b) states that: *Requests for extension or renewal of the authorisation shall be accompanied by a justification that safety related SCC are not affected.*

  • GS 6.04 (transport casks applications) recommends a Design review (new techniques, data, operative experience, change in design parameters due to modifications, etc...) ~ Gap Analysis.
TRANSPORT AND STORAGE SAFETY CASES: COMPARISON

**IS-20**

1. General description.
2. Design criteria.
5. Shielding Evaluation.
10. Acceptance Tests and maintenance program.
11. Radiological protection.
12. Accident Analyses

**GS 6.04**

- General information
- Specifications of the radioactive content of the package
- Packaging specifications

1. Classification of package type and assessment of compliance with general packaging requirements
2. Structural evaluation
3. Thermal evaluation
4. Containment evaluation
5. Shielding evaluation
6. Criticality evaluation
7. Package operations
8. Acceptance testing and maintenance program.

**It would be possible to have an unique safety report.**
## SPANISH REGULATORY REQUIREMENTS vs. TECDOC

<table>
<thead>
<tr>
<th>TECDOC</th>
<th>Storage facility</th>
<th>TRANSPORT</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Part I: Administrative information</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Specification of Content</td>
<td>IS-20</td>
<td>ADR/GS 6.04</td>
</tr>
<tr>
<td>Specification of DPC</td>
<td>IS-20 (§ 3.1.13)</td>
<td>ADR/GS 6.04</td>
</tr>
<tr>
<td>Storage and transport conditions</td>
<td>IS-20 (Interdependencies § 3.1.13)</td>
<td>ADR (only transport)</td>
</tr>
<tr>
<td>General Design considerations</td>
<td>IS-20 (§ 3.1)</td>
<td>ADR/GS 6.04/IS-34</td>
</tr>
<tr>
<td><strong>Ageing considerations</strong></td>
<td>IS-20 (§ 3.6.3 and § 5.11)</td>
<td>GS 6.04</td>
</tr>
<tr>
<td>Compliance Regulatory Req.</td>
<td></td>
<td>ADR-</td>
</tr>
<tr>
<td>Operation</td>
<td>IS-20</td>
<td>ADR.</td>
</tr>
<tr>
<td>Maintenance Plan</td>
<td>IS-20 (§ 5.11)</td>
<td>ADR</td>
</tr>
<tr>
<td>Emergency Plan</td>
<td>IS-20 (Accident analyses)</td>
<td>ADR (transport conditions)</td>
</tr>
<tr>
<td>Management System</td>
<td>IS-20</td>
<td>ADR/GS 6.01 and 6.04</td>
</tr>
<tr>
<td>Ageing management program</td>
<td>I-20 (§ 3.6.3)</td>
<td>-</td>
</tr>
<tr>
<td>DPCSC periodic review</td>
<td>IS-20 and Approval conditions</td>
<td>Approval conditions</td>
</tr>
<tr>
<td>Record management</td>
<td>IS-20(§ 5.15)</td>
<td>ADR</td>
</tr>
<tr>
<td>Decommissioning</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Part II: Common Provisions.</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Structural Analysis</td>
<td>IS-20</td>
<td>ADR/GS 6.04</td>
</tr>
<tr>
<td>Thermal Analysis</td>
<td>IS-20</td>
<td>ADR/GS 6.04</td>
</tr>
<tr>
<td>Activity Release Analysis</td>
<td>IS-20</td>
<td>ADR/GS 6.04</td>
</tr>
<tr>
<td>External Dose Rate Analysis</td>
<td>IS-20</td>
<td>ADR/GS 6.04</td>
</tr>
<tr>
<td>Criticality Analysis</td>
<td>IS-20</td>
<td>ADR/GS 6.04</td>
</tr>
</tbody>
</table>
PERIODIC SAFETY REVIEW (PSR)

• Design cask approval certificate for storage and package approval require to send an annual report containing
  - Technical inspections and tests (related to manufacturing and operational tests)
  - Operational experience and reportable events
  - Design modifications [following either IS-20 (storage) or IS-35 (transport)]
  - new regulations analysis
  - relevant international experience

• An update of the Storage Safety Analysis Report is required at least every two years (IS-20, § 5.5)

• Interim Storage is subjected to the PSR of the whole NPP, as a part of it, conducted every 10 years (IS-26 and IS-29):
  ▪ The scope of this PSR is required by including the assessment of aspects such as operating experience, equipment performance, impact of regulations changes and status of improvement and safety assessment programs.
  ▪ According to the above requirement, only one PSR has been submitted recently including an interim storage facility safety Review. The report includes the evaluation of new standards and operational experience. The focus of this PSR is on the facility and cask operations, not over the cask itself.

• Future centralized storage facility should also be subjected to a Periodic Safety Review requirement (IS-29).
14 AGEING MANAGEMENT (DPC)

- **Storage Cask IS 20**
  
  § 3.6: *The cask shall be designed to ensure that throughout the design lifetime there are no significant chemical or galvanic reactions between the materials used [...] Consideration shall be given to the thermal effects and the irradiation of these materials. [...] and to ageing of the SSCs, with a maintenance, testing and inspection programme. The results will serve as a basis for periodic safety review.*

  § 5.11. The licensee shall develop the Maintenance Manual, periodic tests and inspections, the surveillance system and the consideration of ageing of the SSCs in accordance with a programme

- **Transport Cask**
  
  There are some considerations on ageing in GS 6.04. *It recommends to have maintenance and inspection programs in order to verify the correct behavior of the cask over the time* (those programs are required later as a condition in the package approval). **Transport Regulation includes aspects related to ageing considerations** (no cracks, closure devices, loading procedures, neutron absorber, etc)

- **Interim Storage → NPP**
  
  According to the Safety Instruction **IS-26** (Art 7.19) the Nuclear Power Plant should have an ageing Management Program to cover safety related structures, systems and components identifying degradation effects/mechanisms and mitigating programs. However, the ageing management program is not oriented clearly over the cask.

- **Future Centralized Storage Facility.**
  
  It will be covered by the **IS-29.** (Art. 4.9) The safety Analysis Report should include a periodic safety analysis program and the ageing considerations.

  **ageing considerations are required although there is not a specific guide to developed it systematically**
CONCLUSIONS

It is expected the spent fuel will be stored in dry casks less than 20 years

- Harmonization between Transport and Storage Safety cases.
  - Spanish licensing process takes into account both storage and transport requirements.
  - A common Safety Case would be possible.

- A comparison on the regulatory requirements vs. TECDOC has been done.
  - Spanish Regulation covers all the aspects included in the TECDOC.
    - There are requirements for an Ageing Management Program but there is not a specific guide to develop it. → it is not a priority, considering the expected storage of fuel in dry cask (less than 20 years)
    - There are different Periodic Safety Reviews for the cask, the interim storage and the centralized storage facility, although there is not an holistic approach → not a priority to change legal framework, since all the activities related with spent fuel management are responsibility of one agency.

TECDOC will be a document to bear in mind in the development of future guidance.
Thanks for listening