Safety considerations for the Interim Storage Solution

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Outline

- Overview of the interim dry storage solutions
- Storage Safety Assessment and Aging Management
- Conclusions
Interim dry Storage Solutions

- Interim storage of used fuel, basic principle
  - Limited time, 30 to 40 years
  - Allow for used fuel cooling

- Different systems to store used fuel designed by AREVA
  - In use for decades
  - Safety records: experience covering more than 30 years

Vaults (Cascad type)  Metal casks (TN®24)  Canister based systems (Nuhoms®)
Track Record of AREVA TN Experience

- AREVA TN is an experienced provider of storage technology in the world

- **USA**
  - First NUHOMS® system loaded at Robinson ISFSI in March 1989
  - First TN® 24 cask loaded at McGuire in 1988 (in 1984, the TN® 24P has been loaded for tests)

- **Japan**
  - First TN® 24 cask loaded at Fukushima Dai-ichi NPP in 1995

- **Belgium**
  - First TN® 24 cask loaded at Doel in 1994

- **Switzerland**
  - First TN® 24 cask loaded at Zwilag in 2000

- **Armenia**
  - First NUHOMS® system loaded at Medsamor NPP in 2000

- More than 300 TN® 24 casks loaded
- More than 800 canisters systems loaded
The New Generation of storage systems

- NUHOMS® next generation: NUHOMS® Extended Optimized Storage (EOS):
  - the highest capacity and heat load
  - 37 PWR or 89 BWR
  - up to 50 kW
  - burnup of up to 62 GWd/tHM
  - maximum allowable enrichment as high as 5%

- TN®24E: Dual Purpose Casks for the German Market
  - the highest capacity and heat load
  - 21 PWR – UO2 or MOX (up to 17 MOX)
  - up to 39 kW
  - burnup of up to 65 GWd/tHM
  - maximum allowable enrichment as high as 4.65%
Safety Proven Records

- Demonstration tests were done by the Idaho National Engineering Laboratory on the AREVA TN-24P cask and NUHOMS® system

- US – Post Irradiation Examination of spent fuel assemblies stored 15 years in metal cask
  - no significant deterioration to cask or FAs

- Japan – Post Irradiation Examination
  - Integrity inspections of TN24 cask performed after 5 and 10 years of storage loaded with 52 BWR assemblies (≈30GW d/tU)
  - no release of inner gas (Kr-85) and no defect observed on the assemblies
Safety Assessment

The system has been designed to ensure the safety of the used fuel during the storage period and transportation.

- Maintain subcriticality
- Prevent release of radioactive material above acceptable amounts
- Ensure radiation rates and doses so as not to exceed acceptable levels
- Maintain retrievability of stored radioactive materials throughout the life of the dry system
Safety Assessment in severe accident

Main Accident Conditions during Storage

- Cask drop
- Cask flooding
- Fire
- Earthquake
- Cask burying
- Aircraft crash

- Aircraft crash test on TN NOVA™
Storage Extension

- Storage duration may have to be extended, potentially beyond one century
  - Necessity to reevaluate safety assessment
  - Consideration needs to be given to potential aging deterioration of component materials

- The main objectives of the aging management program are:
  - to ensure that the interim storage safety functions are maintained in the long term,
  - to study the degradation phenomenon and mitigate the degradation,
  - to address safety issues based on R&D on storage systems, components and used fuel.
Conclusion

- Vast industrial experience and numerous safety studies have shown the ability of interim dry storage systems to protect the public and manage safely used nuclear fuel in the long term.

- The interim dry storage solution is a key component of a used fuel management program while reprocessing or the implementation of final disposal is put in place.

Responsible towards coming generations: Develop Geological Repository actively and minimize interim storage duration
Thank you for your Attention

Questions?

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