



Development of a New Dual-Purpose Cask

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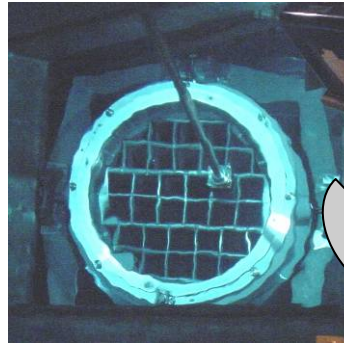
LOGISTICS



Dual purpose casks: Storage & Transport Casks

▶ AREVA Logistics BU expertise

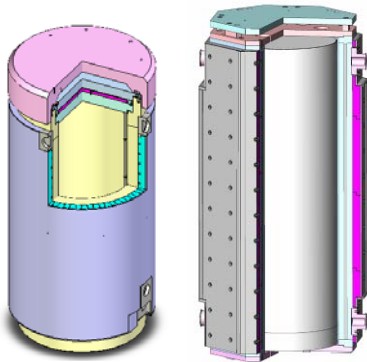
- ◆ TN 24[®] family
- ◆ Tailor made casks for the specific needs of the operators
- ◆ More than 240 casks loaded since 1990
- ◆ More than 20 versions designed for customers in the US, Europe and Japan



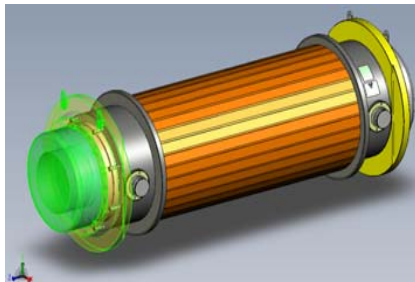
Innovation within AREVA Logistics BU



Innovation – a key driver within the Logistics Business Unit



Dry Storage innovative Solutions



New Transport cask

LOGISTICS

An increasing market for fuel management solutions worldwide

Tough Competition

Be ready for higher enrichment, burn-up...

Nuclear Renaissance

Need to anticipate regulatory evolutions

Adaptation to the dry storage market internationalization

Offer competitive casks with larger capacity

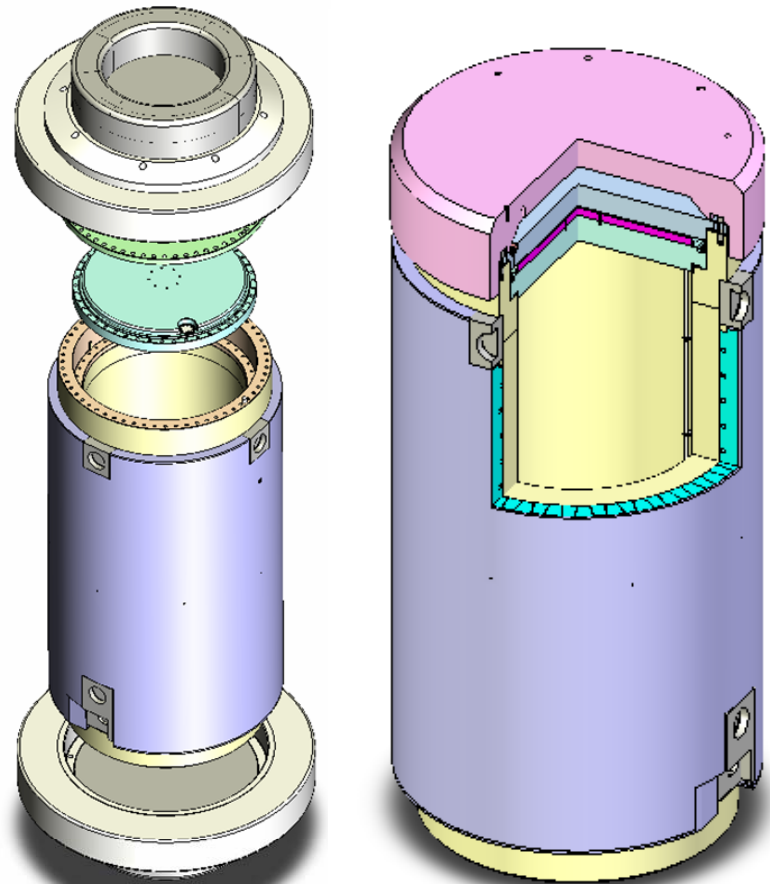
Recent increase of massive forged pieces demand in the industry

Design casks compatible with decommissioning strategies

» To meet all these challenges, the Logistics BU engaged a step of innovation to develop competitive, efficient and relevant transport and storage solutions

TN[®]DUO, The new line of dual purpose casks

- ▶ **TN[®]DUO concept**
 - ◆ The massive shell is composed by several forged pieces
 - ◆ neutron shielding surrounding the forged shell
 - ◆ Aluminum heat exchanger
 - ◆ basket mainly based on aluminum with boron
- ▶ **Robust to aircraft crash**
- ▶ **Retrievability of stored components**
- ▶ **Passive system**
- ▶ **Same or similar operating procedures as TN24 family**



*TN[®]DUO in Transport configuration
& in Storage configuration*



TN[®]DUO Basic Concept

▶ Shielding of radiation

- ◆ Vessel in forged steel providing the main gamma shielding
- ◆ An external layer of neutron shielding resin covered by an outer steel shell

▶ Safe enclosure of radio-active material:

- ◆ the forged steel body and the lids equipped with metallic gaskets make the containment

▶ Leak tightness

- ◆ Permanent monitoring system demonstrates the high efficiency of the containment barrier

▶ Subcriticality of the package

- ◆ Basket made of boronated aluminium and/or stainless steel

▶ Removal of decay heat

- ◆ Aluminium heat exchanger between the cask body and the cask external surface

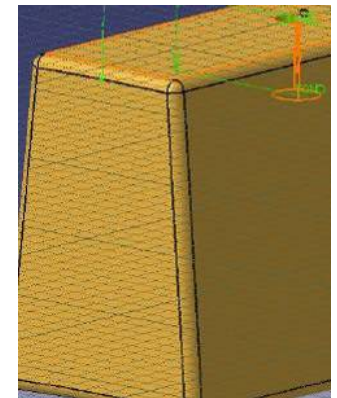
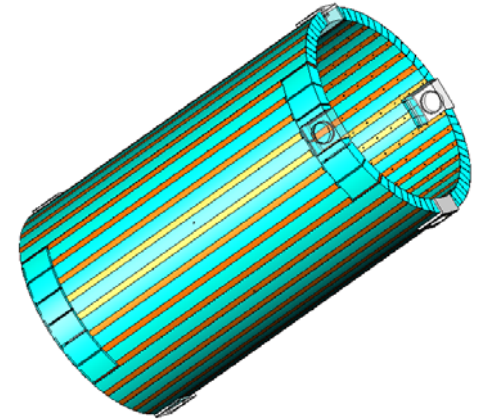
▶ Mechanical strength

- ◆ The shock absorbing covers provide the protection required for transport licensing.
- ◆ Anti-aircraft crash cover provides the protection against an airplane crash on the storage facility (if required by storage regulation)

Main innovations of the TN[®]DUO



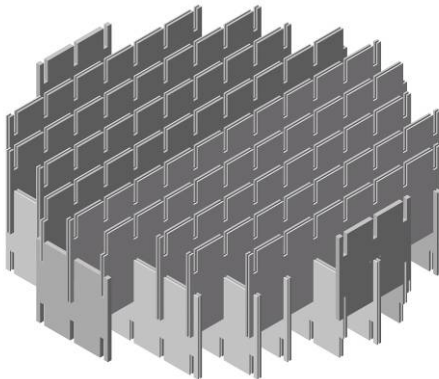
- ▶ A new body
- ▶ A new outer shell composed of aluminum heat conductors, resin blocks and steel external shell
- ▶ A new basket design using the metal matrix composite (MMC) with boron.
- ▶ Efficient shock absorbers made of stainless steel and carbon foam.
- ▶ high performance resin poured on the outside of the shell for neutron shielding



TN[®]DUO content

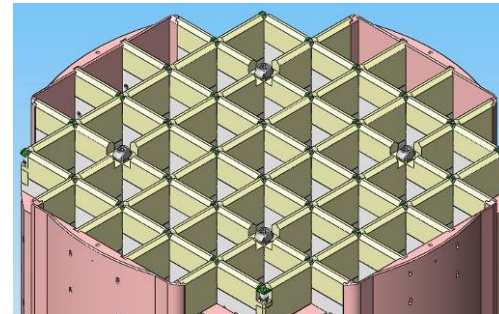
BWR version

- ▶ Cask availability 2015
- ▶ Capacity:
 - ◆ 52 to 68 BWR Intact Fuel Assemblies
- ▶ Fuel:
 - ◆ Max Burnup: 70 GWd/MTU
 - ◆ Max Initial Enrichment: 5 wt % U235



PWR version

- ▶ Cask availability 2015
- ▶ Capacity:
 - ◆ 24 to 37 PWR Intact Fuel Assemblies
- ▶ Fuel:
 - ◆ Max Burnup: 65 GWd/MTU
 - ◆ Max Initial Enrichment: 5 wt % U235

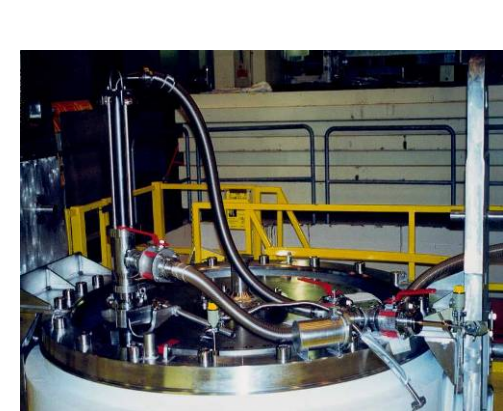
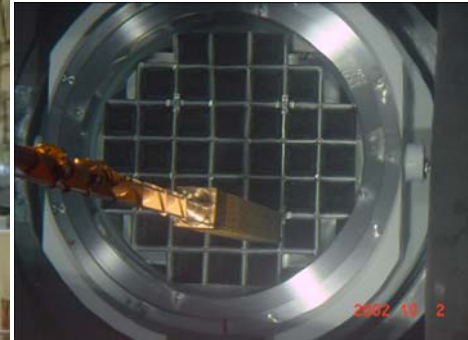


TN[®]DUO characteristics



TN[®]DUO cask	PWR version
Weight of the transport auxiliaries (axial and lateral impact limiters)	~ 18,000 kg
Weight of the loaded cask	~ 130,000 kg
External diameter (transport configuration)	~ 3,200 mm
External length (transport configuration)	~ 6,500 mm

Typical operations



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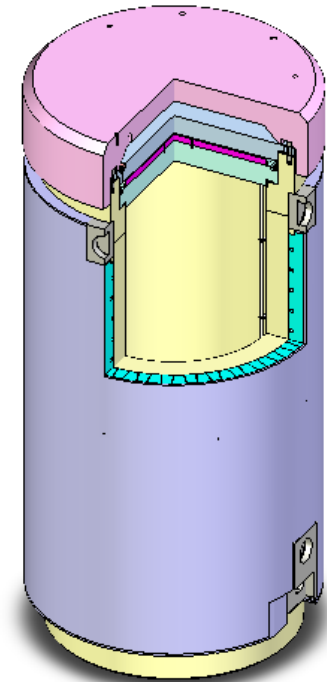
TN[®]DUO Advantages

The result of an intensive innovation process

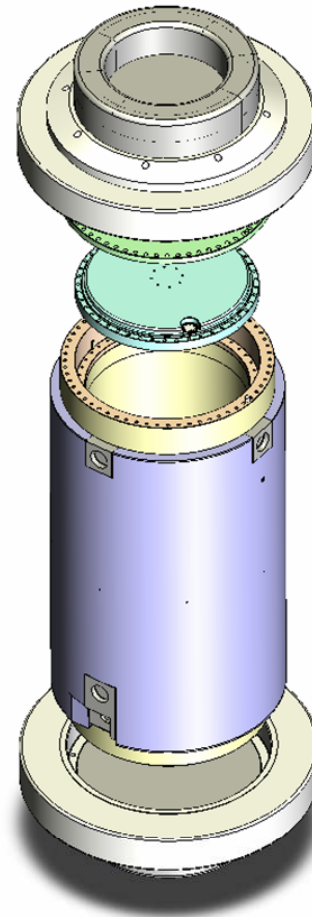
- ◆ A dual-purpose cask (transport and storage) compliant with IAEA 2005 regulations
- ◆ New aluminium heat exchangers
- ◆ A new basket design
- ◆ Resin blocks
- ◆ Efficient shock absorbers
- ◆ The TN[®]DUO incorporates the latest advances
- ◆ Smart design features

- ◆ Same operating procedures and tools as TN[®]24 cask family

TN[®]DUO



*Thank you
for your attention*



TN[®]DUO