Development Program of Cask Technologies for Management of Spent Fuel Assemblies from Russian NPPs as Means of Harmonization of Decisions for SNF Long-Term Storage

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Main SNF management options

Transport and/or Storage cask

NPP → SF Storage pool

Transport cask

Transport and/or Storage cask

Long-term storage

Wet (pool type)

Dry Vault

Dry Single-purpose casks

Dry Double-purpose casks

Reprocessing

Final disposal

Recycle product

HLW disposal

The cask for SFA transportation and/or storage is used for all SNF management options
Russia strategy of SNF management

RBMK-1000
- Reactor units
- Storage pools
- SNF wet storage

VVER-1000
- Reactor units
- Storage pools

VVER-440, BN-600
- Reactor units
- Storage pools

Mining and Chemical Plant (MCC)
- Wet SNF storage
- Dry vault SNF storage
- Pilot demonstration center for reprocessing

Mayak Production Association
- SNF Reprocessing

Depot of Casks
## Modernization of Depot Casks

<table>
<thead>
<tr>
<th>Type</th>
<th>Model</th>
<th>Capacity</th>
<th>Decay heat</th>
<th>Enrichment max</th>
<th>Burn-up max</th>
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</thead>
<tbody>
<tr>
<td>RBMK-1000</td>
<td>TUK-109</td>
<td>144 ПТ SFA 5,6 kW 2,6 % 30 GWd/t(_{HM}) Transportation and storage</td>
<td>Capacity Decay heat Enrichment max Burn-up max</td>
<td>155 ПТ SFA 8,4 kW 3,2 % 37 GWd/t(_{HM}) Transportation</td>
<td>TUK-109T</td>
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<tr>
<td>VVER-440</td>
<td>TUK-6</td>
<td>30 SFA 20 kW 3,6 + 4,4 % 57 GWd/t(_{HM})</td>
<td>Capacity Decay heat Enrichment max Burn-up max</td>
<td>36 SFA 30 kW 4,87% 67,9 GWd/t(_{HM})</td>
<td>TUK-140</td>
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<tr>
<td>VVER-1000</td>
<td>TUK-13</td>
<td>12 SFA 20 kW 4,4 % 58 GWd/t(_{HM})</td>
<td>Capacity Decay heat Enrichment max Burn-up max</td>
<td>18 SFA 36 kW 4,87% 67,9 GWd/t(_{HM})</td>
<td>TUK-141</td>
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</tbody>
</table>

Modernization is carried out
Cask technologies for RBMK-1000 SNF management

TUK-109 – dual-purpose metal-concrete cask for transportation and long-term storage of RBMK-1000 SNF

UKKh-109
Storage cask

TUK-109
Transport cask
UKKh-109 + ZDK (damper container)
Family of dual-purpose casks based on metal-concrete cask technologies

- UKKh-109 (TUK-109) RBMK-1000 SNF
- UKKh-121 HLRW
- UKKh-123 (TUK-123) BN-350 SNF
- TUK-108/1 Navy SNF
- TYK-120 Icebreaker SNF
Infrastructure for RBMK-1000 SNF cask handling
TUK-140 and TUK-141 casks

TUK-140 and TUK-141 are packages of B(U) type for transportation of VVER SFA having higher enrichment by U-235 and burn-up
TUK-141 dual-purpose cask for higher burn-up fuel

**Body** – high-strength cast iron with spheroidal graphite

**Spacer greed** – stainless and boron steel

**Solid neutron shielding**

- SFA capacity, pcs.: 18
- TUK lifetime, years: 60
- SNF storage period, years: 60
- Full weight (with SFA) of TUK including dampers, t: 125
- Weight of empty TUK including dampers, t: 98
- Max height including dampers (without dampers), mm: 7120 (5860)
- Max diameter including dampers (without dampers), mm: 3120 (2770)
Advantages of dry storage using dual-purpose casks

- Reduction of operation costs
- Modular design – possibility to expand the storage facility
- Independence of infrastructure facilities commissioning for reprocessing
- Enhanced storage safety
- Less number of SNF reloading operations (reactor cooling pool - cask)
- Mobility in decision-making on further SNF management strategy
- Technology unification
Cask unification

Using of unitized dual-purpose cask will decrease SNF management cost
Global experience

Open site storage

The dry RBMK-1500 spent fuel cask storage site at the Ignalina NPP (Lithuania)

The Independent Spent Fuel Storage Installation (ISFSI) Maine Yankee NPP (USA)

Closed-in storage

Interim VVER-440 Spent Fuel Storage Facility Dukovany (Czech Republic)

The Dry VVER-440 Spent Fuel Storage in Kozloduy NPP (Bulgaria)

VVER-1000 Spent fuel storage facility (SFSF) Temelin NPP (Czech Republic)
Programme of Development

FCNRS programme of cask technologies development

- Modernization of Depot Casks
- Development of dual-purpose cask
- Development of storage site
- Experience of dry cask storage site

Development and manufacturing of new transport casks for VVER-1000 and VVER-440 SNF
Development and manufacturing of dual-purpose casks for VVER-1000 SNF
Development and building of storage site
Loading of SFA into dual-purpose cask and placing it on storage site
Commercial operation of dry cask storage facilities for VVER-1000+ SNF
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