Japanese Cask Vender's Prospective on Design, Licensing and Fabrication of DPC

May 21, 2014

Ryoji Asano
Hitachi Zosen Corporation
Contents

• Japanese venders and their business history
• Applicability of transport cask technology to dual purpose casks
• Characteristic technology required for dual purpose casks
• Technology to maintain performance during storage period and transportation after the storage
Japanese Cask Vendors

• There are several cask venders in Japan, who deliver casks and canisters for LWR spent nuclear fuels.
• They have functions of both design development and fabrication, which may be big different from other countries.
• While they are not allowed to apply design license in Japan, they have enough knowledge on licensing through design development and preparation of licensing documents.
Introduction of Hitachi Zosen Corporation

• HZC is one of the Japanese cask venders.
• Since it delivered the first (transport) cask in 1978, it delivered more than 700 units of casks and canisters to all over the world.
• Same as other Japanese cask venders, HZC entered into the cask business as a transport cask vender.
• Since 2000, the market trend was changed. Main demand has moved from transport casks to storage or transportable storage casks.
Delivery History - Transport Cask

Design & Fabrication

HZ-75T (1978-1993)

1978

NH25T (1979)

EXL-3B/3 (1982-84)

TN 12 (1985-87)

Monju PIE (1994)

NFT 14P (1997-09)

NAC LWT (2000)

Fabrication

2014
Delivery History of Storage, and Dual Purpose Casks/Canisters

Design & Fabrication

NAC S/T (1988)

JAPC DSC (2001-present)

Concrete Cask Canisters (2000-present)

Fabrication

1988

2014
Applicability of Transport Cask Technology to Dual Purpose Casks

- The technology which the cask vendors achieved through transport cask is applicable to dual purpose casks.

Neutron Absorbing

Neutron Shielding

Shock Absorbing

Material Development

Design Development
Developed Fabrication Equipments

- Electron Beam
- Laser
- Robot
- Lead Pouring
- $\gamma$-scan
- Inner fin welding

Welding for Basket

Equipments for Body
Comparing Design Conditions; Transport vs Storage

<table>
<thead>
<tr>
<th>conditions</th>
<th>transportation cask</th>
<th>storage cask</th>
</tr>
</thead>
<tbody>
<tr>
<td>operation condition</td>
<td>✓ environment conditions including sola isolation</td>
<td>(environment conditions)</td>
</tr>
<tr>
<td></td>
<td>✓ transportation condition such as vibration at transport and lifting load at handling</td>
<td>✓ Temperature,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>✓ atmospheric pressure</td>
</tr>
<tr>
<td>normal</td>
<td></td>
<td>✓ Wind, snow</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(handling)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>✓ lifting load</td>
</tr>
<tr>
<td>abnormal</td>
<td>(test conditions)</td>
<td>(handling)</td>
</tr>
<tr>
<td></td>
<td>✓ water spray</td>
<td>✓ Drop, collision, tip over</td>
</tr>
<tr>
<td></td>
<td>✓ free drop</td>
<td>(natural disasters)</td>
</tr>
<tr>
<td></td>
<td>✓ stacking</td>
<td>✓ tornado/typhoon</td>
</tr>
<tr>
<td></td>
<td>✓ penetration</td>
<td>✓ earthquake, tsunami</td>
</tr>
<tr>
<td>design basis accident</td>
<td>(test conditions)</td>
<td>(storage period)</td>
</tr>
<tr>
<td>conditions</td>
<td>✓ 9 meter drop</td>
<td>✓ material degradation</td>
</tr>
<tr>
<td></td>
<td>✓ 1 m drop</td>
<td></td>
</tr>
<tr>
<td></td>
<td>✓ fire</td>
<td></td>
</tr>
<tr>
<td></td>
<td>✓ water immersion</td>
<td></td>
</tr>
<tr>
<td></td>
<td>✓ enhanced water immersion</td>
<td></td>
</tr>
</tbody>
</table>

Design conditions for storage casks are almost covered by those of transport casks.
Characteristic Technology for Dual purpose Casks

• Long storage period requires to consider aging effects.
• However, the requirements are vague and not so concrete.
• Accumulation of experience data is necessary for concrete requirements.
The Precedent Storage Test performing in Japan

- The precedent storage tests being performed in Japan are very useful to address what is necessary for a long period.

Result and Evaluation

- No scratch, crack or oxidation was observed.
- The integrity of metallic gasket was confirmed.

Extracted from the presentation of Mr. T. Fujimoto of JAPC at IAEA Technical Meeting on Very Long Term Storage of Used Nuclear Fuel, April 26-28, 2011.
What Should be Done for the Future

• Maintain the technology for the long storage period.
• To secure continuous projects and human resource are very important.

Examples for maintain the technology
There is an examples in Japan for long-term preservation of property, that is so-called “Shikinen Sengu”. This is to reconstruct the shrine building once every 20 years. It is continuing for 1300 years. The purpose of the “Shine Sengu” is to realize the permanence of the shrine and succession of the traditional technology.

Extracted from Ise Shrine home page http://www.sengu.info/gyoji.html
Conclusion and What Cask Venders can

Conclusion:
• Transport technology which cask venders developed is valuable for dual purpose casks too.
• Additional technology required for dual purpose casks is regarding aging effect, but the requirements are vague and not so concrete.
• Maintaining technology for the storage period and transportation after the storage is very important.

What cask venders should do:
• To maintain their design development and fabrication functions, high quality and on-schedule delivery
Thank you for your attention!