TN-LC Transport Cask Application, CoC 71-9358 RSI Responses (Non-Proprietary)

AREVA

Structural Evaluation

- **RSI 1 – Proprietary**
- **RSI 2**
  - The analysis performed for the TN-LC fuel end analysis is consistent with the approach of the recently approved TN-40 transportation cask
  - Initial velocity was applied and the fuel pin decelerates due to the impact limiter spring
  - No nodal force was applied
  - SAR will be updated to correct the statement
- **RSI 3**
  - The force-deflection curves of the springs will be added to the SAR
- **RSI 4**
  - For overlapping to occur, poison plates at the bolt holes must shear. Calculation demonstrating that overlapping does will not occur will be added to the SAR
- **RSI 5 - Proprietary**

Structural Evaluation

RSI 6 (Part 1 of 2)

- The drawing notes will be revised and merged into one single identical note per drawing, in order to ensure that any alternate welding configuration will be analyzed prior to implementation and compared with the allowable stresses defined in the safety analysis, to ensure compliance with Part 71 requirements. The revised note reads:

- "PARTIAL PENETRATION WELD SIZES SHOWN ARE THE REQUIRED EFFECTIVE THROAT. ALL WELD PREPARATION GROOVES TO BE SIZED ACCORDINGLY. MINIMUM WELD SIZES ARE SPECIFIED ON ALL DRAWINGS. ALTERNATE WELD CONFIGURATIONS MAY BE USED UPON TN APPROVAL, PROVIDED THE STRESSES CALCULATED FOR THE ALTERNATE WELD CONFIGURATIONS ARE BOUNDED BY THE ALLOWABLE STRESSES DEFINED IN THE SAFETY ANALYSIS".

Structural Evaluation

RSI 6 (Part 2 of 2)

- Regarding note 14 of 65200-71-20 rev. 0: the sole safety function of this weld is to ensure leak tightness of the impact limiter shell, in order to maintain the moisture content of the wood contained in the shell to the range of values specified on the drawing in note 10.
- The particular area of the impact limiter this note is pointing to is the junction between three components of the impact limiter: the inner shell (item 2 of drawing 65200-71-20 rev. 0), where the weld might prove difficult to make because of the complicated geometry of the joint. The purpose of note 14 is to clarify the design intent of the weld (impact limiter leak tightness) for the purpose of facilitating fabrication. Therefore, TN believes that no revision of this drawing is necessary.

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Material Evaluation

- **RSI 7**
  - **Elastomer chosen on basis of manufacturer's rating that material will function at -40°C.**
  - **One parameter used to determine suitability is the T-10 value which is given as -31°C in the SAR Chapter 4, Reference 8.**
  - **Multiple other references state that for a static seal, sealing performance is maintained as low as 15°C below the T-10 value. Two of these references are provided below:**
    - http://machinedesign.com/article/relating-material-tests-to-seal-performance-0323
    - http://www.pspglobal.com/prop-thermal-stability.html

Material Evaluation

- **RSI 8**
  - **Data described in Reference 8 of SAR Chapter 4, Section 4.5 indicate that the effect of radiation on Viton-type elastomers is such that the seals used in the TN-LC are adequate. Figures 11 through 13 of this reference show that the time and temperature are the most important variables at the radiation levels predicted. Note also that these seals are used in a static application and are required to seal a relatively low pressure containment vessel.**

Thermal Evaluation

- **RSI 9**
  - **TN has designed and manufactured casks with this type of radial neutron shielding assembled by:**
  - **PX Engineering (TN-40), Kobe Steel (TN-68 and -40), ENSA (TN-68), PCC(TN-32, -40, & -68), and Ranor (TN-32).**
  - **The MP197 transport cask approved by NRC under CoC 71-9302 uses the same design of radial neutron shielding**
  - **Two thermal tests were performed on the TN-32 at PCC and at Ranor**
    - The test results were summarized and sent to NRC for review
    - The tests demonstrated that the assumed gaps are conservative using fabrication method at Renor
  - **The margin to the temperature limits is 133°F for research reactor fuels and 210°F for commercial fuels as shown in Table 3-2 of the SAR**
  - **The assumed gaps are removed during fire accident (the properties changed to the properties of one of the adjacent components) and then restored after the fire accident as described in the SAR Section 3.4.2 and Table 3-21.**
  - **Fabrication detail is provided in a proprietary response**

Thermal Evaluation

- **RSI 10**
  - **Information from references, including other application's documents, will be provided as additional attachments to the submitted package application**

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Shielding Evaluation

- **RSI 11**
  - The TRITON module of SCALE6 computer code system is employed to determine the source terms corresponding to the burnup, enrichment and cooling time of the design basis BWR and PWR fuel assemblies
  - The TRITON calculated source terms are compared to the SAS2H calculated source terms using the Response Function described in Appendix 5.6.4, Section 5.6.4.2.2 of the SAR
  - This comparison to the higher fidelity, 2D TRITON depletion methodology, would provide the basis for the acceptance of the source term results from SAS2H evaluation for the TN-LC-1FA basket
  - Note that the source terms for the other three baskets are calculated using the TRITON methodology

Criticality Evaluation

- **RSI 12**
  - Preferential flooding is not credible since the TN-LC cask and the four baskets are designed to drain freely. Therefore, the only credible scenario is that some fuel would be submerged in water, and the remaining fuel would remain un-submerged
  - Cases are run with reduced water density in the package cavity for each of the fuel and basket types which demonstrates that full-density water results in the most reactive condition
  - The SAR Appendices for each of the four TN-LC basket designs are revised to provide the clarification addressing partial / preferential flooding

Observations

- Observation 1 – The notations will be clarified, the end drop load analysis is bounded by the lid drop analysis performed in Appendix 2.13.7.
- Observation 2 – The SAR will be updated with the description and justification for the physical attributes of the dummy composite model
- Observation 3 – Tables 2.13.8-9 and 2.13.8-12 will be updated to agree with Table 2-3
- Observation 4 – Proprietary
- Observation 5 – Proprietary
- Observation 6 – The accelerations were scaled by 1/3 to represent the accelerations of the full scale cask. Impact duration and crush depths are unchanged. The SAR will be updated.