NAC International

Docket No. 71-9225

NON-PROPRIETARY REQUEST FOR SUPPLEMENTAL INFORMATION AND OBSERVATIONS

RELATED TO THE PROPOSED NAC-LWT REVISION

Structural Evaluation

1. Revise the structural evaluation to show that differential thermal expansion and contraction of the inner containers will not contact the containment boundary.

   While the application should discuss differential thermal expansion for normal conditions of transport and hypothetical accident conditions, the application should also show that there will not be any contact between the containment boundary and the high-enriched uranyl nitrate liquid (HEUNL) inner container that would challenge the package's containment for thermal expansion of the inner container and contraction of the containment boundary during evaluation of the cold test.

   This information is needed to demonstrate compliance with Title 10 *Code of Federal Regulations* (10 CFR) 71.51 (a)(1) and (2).

Materials Evaluation

1 Provide data that there are no significant chemical, galvanic, or other reactions between the uranyl nitrate solution and its constituents and either the steel HEUNL inner container or its o-ring seals on the port valve covers. The analysis should include the potential generation of hydrogen from chemical reactions and radiological interactions

   No information addressing the interaction of the uranyl nitrate with the packaging components was found in the application.

   This information is needed to demonstrate compliance with 10 CFR 71.43(d).

Thermal Evaluation

1. Revise the application to ensure that the pressure within the containment boundary and the HEUNL container is based on the most bounding pressure considering the hot and cold tests for normal conditions of transport. In addition, for completeness, provide the pressure inside an empty HEUNL container during the fire test for hypothetical accident conditions. Also, provide the design pressure limit for the HEUNL container.

   The staff needs to ensure that pressure created from any of the tests for normal conditions of transport and hypothetical accident conditions within the containment boundary and within the HEUNL containers have been evaluated and are discussed in the application and are completely summarized in Chapter 3 of the safety analysis report

(SAR). The application did not appear to provide an analysis of the pressure inside the containment boundary and the HEUNL container for the cold test required for evaluations of normal conditions of transport. The pressure on the HEUNL container from the frozen HEUNL that has expanded during the cold test was not addressed. The pressure inside the containment boundary may increase due to a decrease of the available volume inside the containment boundary due to both expansion of the HEUNL inner containers and thermal contraction of the containment boundary of the package.

The application does not appear to address the pressure inside an empty HEUNL container during hypothetical accident conditions or provide the design pressure limit for the HEUNL container.

This information is needed to demonstrate compliance with 10 CFR 71.51.

2. Revise the application to ensure the pressure calculations for both normal conditions of transport and hypothetical accident conditions consider all possible sources of gases, such as those gases initially present in the package; saturated vapor, including water vapor from the contents or packaging; helium from the radioactive decay of the contents; and hydrogen or other gases resulting from thermal or radiation induced decomposition of materials such as water or plastics. Also, demonstrate that hydrogen and other flammable gases comprise less than 5% by volume of the total gas inventory within any confined volume.

   The application does not appear to address the impact on the maximum normal operation pressure (MNOP) and the pressure within the cask cavity (for normal conditions of transport and hypothetical accident conditions), and within the HEUNL containers from all possible sources. The application also does not appear to show that hydrogen or other flammable gases comprise less than 5% by volume of the total gas inventory within any confined volume.

   This information is needed to demonstrate compliance with 10 CFR 71.33(b)(5) and 71.43(d).

3. Provide the ANSYS thermal input and output files for normal conditions of transport.

   The ANSYS thermal input and output files for normal conditions of transport are necessary in order to verify the modeling assumptions and the results shown in the application. The staff specifically prefers text-based files with an appropriate level of comments to allow for a timely technical review.

   This information is needed to demonstrate compliance with 10 CFR 71.71.

Containment Evaluation

1. Confirm that HEUNL will not be released from HEUNL containers during normal and accident conditions, or, confirm the integrity of the containment boundary if there were a release from the HEUNL containers into the Model No. NAC-LWT packaging.

   Page 4.1-1 (and 7.1-1) states that no release of material from HEUNL containers is <u>expected</u> [emphasis added] under normal conditions of transport and hypothetical accident conditions. Analyses that confirm HEUNL will not be released from the four

HEUNL containers located within the Model No. NAC-LWT packaging during normal conditions of transport and hypothetical accident conditions should be provided. Otherwise, specify the temperatures, pressures, and stresses that would exist during normal conditions of transport and hypothetical accident conditions if the HEUNL were in direct contact with the containment boundary to confirm the integrity of the containment boundary.

This information is needed to demonstrate compliance with 10 CFR 71.43, 71.71, and 71.73.

2. Clarify that the interaction between the HEUNL container payload and NAC LWT packaging is bounded by previous NAC LWT payloads.

Considering this amendment request is for a new HEUNL payload arrangement, it should be clarified that the interaction between the HEUNL container payload and NAC LWT packaging is bounded by previous NAC LWT payloads, thereby confirming the integrity of the containment boundary during NCT and HAC.

This information is needed to demonstrate compliance with 10 CFR 71.71, 71.73.

Criticality Evaluation

1. Provide the necessary input files so that staff may complete its review of the criticality analysis for the application.

The applicant only provided one input for the SAR. Due to the ambiguity with the geometric terms used to define the criticality models and the corresponding figures in the application (see criticality evaluations observation 1 in Enclosure 2), the staff is unclear as to what was actually modeled. As such, the staff cannot determine whether the design of the Model No. NAC-LWT package has been appropriately represented in the criticality models.

This information is needed to demonstrate compliance with 10 CFR 71.31.

2. Either provide an analysis that evaluates the configuration where uranyl nitrate fills the cavity between the HEUNL container and the inner shell of containment boundary or provide assurance prior to shipment that each HEUNL inner container is positively closed and will not leak.

The applicant models the cavity as dry or flooded with water, but does not consider the possibility of uranyl nitrate filling the cavity volume. By analyzing this possibility, the applicant should cover the situation of a container leaking.

As stated in Section 6.7.2.3, "Criticality Calculations," under <u>10 CFR 71.55 Scoping Calculation</u>:

"Initial scoping analysis evaluates cask interior flooding conditions. Due to the system containing little cavity volume for moderation, flooding conditions have negligible effects on reactivity. Normal and accident configuration casks are expected and are confirmed to be similar from a neutronics perspective."

This information is needed to demonstrate compliance with 10 CFR 71.55(b).

Observations

Thermal Evaluation

1. To assist the staff review, revise Chapter 3 of the SAR to provide summaries, or references to other sections within the SAR that address the MNOP and other pressures within the containment boundary and HEUNL containers during the tests for normal conditions of transport and hypothetical accident conditions pressure. Revise Chapter 3 of the SAR to provide summaries or references to other sections within the SAR that address thermal stresses of the HEUNL containers and the cask cavity during normal conditions of transport and hypothetical accident conditions.

   If this information has been provided in calculation packages, or in other sections of the SAR, it should be summarized or referenced in Chapter 3 of the SAR. The staff needs to ensure that normal conditions of transport and hypothetical accident conditions pressures and thermal stresses within the cask cavity and within the HEUNL containers have been evaluated and are discussed in the SAR and are completely summarized in Chapter 3 of the SAR.

   This information is needed to demonstrate compliance with 10 CFR 71.51(a)(1) and (2)

2. Discuss any impact on pressures and stresses for the HEUNL containers and the containment boundary due to the HEUNL content temperature exceeding the boiling point during the thermal hypothetical accident conditions.

   The maximum predicted HEUNL content temperature during hypothetical accident conditions given in Section 3.5.3.16 of the SAR is 296°F. The boiling point for a diluted mixture of HEUNL given in Section 4.2.2 of the SAR is 100°C (212°F.) The application did not address the impact on pressures and stresses for the HEUNL containers and the containment boundary due to the contents exceeding the boiling point during the thermal test for hypothetical accident conditions.

   This information is needed to demonstrate compliance with 10 CFR 71.33(b)(5), 71.43(d), and 71.51(a)(2).

Containment Evaluation

1. Provide a sketch showing the extent of the containment boundary, including lid/O-ring, vent, and drain port covers/O-rings, etc.

   Chapter 1 and 4 of the consolidated application dated June 18, 2010, briefly describes different O-rings as part of the package. However, details of the containment boundary are often unclear, such as where and when tetrafloroetheylene (TFE) O-rings are used

(see page 4.1-1 of the SAR). A sketch showing the extent of the entire containment boundary would be helpful in understanding the containment boundary.

This information is needed to demonstrate compliance with 10 CFR 71.31, 71.33.

Criticality Evaluation

1. Clarify how the words "interior" and "exterior" are used to explain moderator and reflector conditions for cask array analysis.

   The applicant writes in Section 6.7.2.3, "Criticality Calculations," paragraph 3:

   "After the single cask analysis is complete, cask array analysis is performed to meet 10 CFR 71.59 requirements. Per the standard review plan (NUREG-1617) the 10 CFR 71.59 requirements are met by evaluating a cask array with dry interior and exterior for normal condition and optimum interior and exterior moderated array for accident conditions (see Sections 6.5.5 and 6.5.6 in NUREG-1617)."

   The part about a cask array with dry exterior is not correct, since the model is performed with close reflection on all sides of the array per the requirements in 10 CFR 71.59(a), unless the array is infinite as discussed in Section 6.5.5 of NUREG-1617, "Standard Review Plan for Transportation Packages for Spent Nuclear Fuel." The applicant states that the array is infinite later in the section, but the wording in the paragraph above should be rewritten to be consistent with what is stated in NUREG-1617 and 10 CFR 71.59.

   This information is needed to demonstrate compliance with 10 CFR 71.7(a).

2. Explain the use of a 20 cm water reflector to produce full reflection by water on all sides of the package.

   The applicant writes in Section 6.7.2.3, "Criticality Calculations," under 10 CFR 71.55 Scoping Calculation:

   "In compliance with 10 CFR 71.55 the scoping calculations are based on a single cask with a 20 cm boundary from the cask exterior dimensions. The space between cask and boundary is flooded with full density water to produce a fully water reflected system."

   Full water reflection is defined as reflection by water of 30 cm. Unless the 20 is a typo, it would seem that the applicant used the 20 cm definition from 71.55(f)(1), which is for transport of fissile material packages by air.

   This information is needed to demonstrate compliance with 10 CFR 71.55.

3. Identify the method used to ensure that the density limit of 7.2 $g^{235}U/L$ for HEUNL containers will not be exceeded.

   The applicant states that fissile material in the package is limited to a density of 7.2 $g^{235}U/L$ in Table 1.2.3-14 and Sections 6.1 and 6.7.2.1 of the SAR. However, Chapter 7, "Operating Procedures" does not state how this limit will be ensured.

Also, ensure consistent units within the application for the density limit of 7.2 $g^{235}U/L$. The units are listed as gU/L in Table 1.2.3-14 of the SAR, but should be $g^{235}U/L$ (or g/L ^{235}U) as stated in Section 1.2.3.12 and elsewhere in the SAR.

This information is needed to demonstrate compliance with 10 CFR 71.55 and 71.59.