UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

May 28, 2019

Mr. Richard W. Boyle, Chief
Sciences Branch
Division of Engineering and Research
Office of Hazardous Materials Safety
U.S. Department of Transportation
1200 New Jersey Ave., S.E.
Washington, D.C. 20590

SUBJECT: REQUEST FOR ADDITIONAL INFORMATION FOR REVIEW OF THE REVALIDATION OF THE MODEL NO. TNF-XI PACKAGING (DOCKET NO. 71-3092) (EPID L-2018-LLA-0170)

Dear Mr. Boyle:

By letter dated June 7, 2018 [Agencywide Documents Access and Management System (ADAMS) Accession No. ML18192B131], and as supplemented on October 24, 2018 (ADAMS Accession No. ML18313A069) and February 26, 2019 (ADAMS Accession No. ML19071A145), the United States (U.S.) Department of Transportation requested that the U.S. Nuclear Regulatory Commission (NRC) staff performs a review of the Competent Authority Certification (CAC) USA/0653/AF-96, French Approval Certificate Number F/381/AF-96, Revision Di, Model No. TNF-XI transport package, and make a recommendation concerning the revalidation of the package for import and export use.

In connection with our review, we need the information identified in the enclosure to this letter. To assist us in scheduling the staff's review of your response, we request that you provide this information by the mid-June 2019. Inform us at your earliest convenience, but no later than early June 2019, if you are not able to provide the information by that timeframe. If you are unable to provide a response by mid-June 2019, our review may be delayed.

Please reference Docket No. 71-3092 and EPID L-2018-LLA-0170 in future correspondence related to this request. The staff is available to meet to discuss your proposed responses. If you have any questions regarding this matter, you can contact me at (301) 415-6999.

Sincerely,

/RA/

Norma Garcia Santos, Project Manager
Spent Fuel Licensing Branch
Division of Spent Fuel Management
Office of Nuclear Material Safety
and Safeguards

Docket No. 71-3092
EPID L-2018-LLA-0170

Enclosure:
Request for Additional Information

SUBJECT: REQUEST FOR ADDITIONAL INFORMATION FOR REVIEW OF THE REVALIDATION OF THE MODEL NO. TNF-XI PACKAGING (DOCKET NO. 71-3092) (EPID L-2018-LLA-0170), DOCUMENT DATE: May 28, 2019

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NGarcia-Santos DMarcano

http://fusion.nrc.gov/nmss/team/sfst/sfst-licensing/10_cfr_71/tnf-xi_revalodation/Shared Documents/TNF-XI_RAI_Ltr_R0.docx

ADAMS No.: ML19150A614

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Request for Additional Information
U.S. Department of Transportation
Orano Federal Services LLC
Docket No. 71-3092
Competent Authority Certification (CAC) USA/0653/AF-96
Revision Di
Model No. TNF-XI

By letter dated June 7, 2018 [Agencywide Documents Access and Management System (ADAMS) Accession No. ML18192B131], and as supplemented on October 24, 2018 (ADAMS Accession No. ML18313A069) and February 26, 2019 (ADAMS Accession No. ML19071A145), the United States (U.S.) Department of Transportation requested that the U.S. Nuclear Regulatory Commission (NRC) staff performs a review of the Competent Authority Certification (CAC) USA/0653/AF-96, French Approval Certificate Number F/381/AF-96, Revision Di, Model No. TNF-XI transport package, and make a recommendation concerning the revalidation of the package for import and export use.

This request for additional information (RAI) identifies information needed by the U.S. Nuclear Regulatory Commission staff (the staff) in connection with its review of the application. The staff used the International Atomic Energy Agency (IAEA) safety standard Specific Safety Requirements No. 6 (SSR-6), “Regulations for the Safe Transport of Radioactive Material," 2012 Edition, in its review of the application.

This RAI describes information needed by the staff to complete its review of the application and to determine whether the applicant has demonstrated compliance with the regulatory requirements of IAEA SSR-6, 2012 Edition.

CRITICALITY SAFETY REVIEWER

RAI-Cr-1 Provide the benchmark analysis and validation of the MORET4 code to justify the applicability of this monte carlo code in evaluating the subcriticality of 20 weight percent (wt%) of Uranium-235 (^{235}U).

The applicant has requested an increase in the overall enrichment (i.e., from 5.0 wt% ^{235}U to 20.0 wt% ^{235}U) allowed to be transported in the Model No. TNF-XI as content No. 8. However, the criticality analysis provided by the applicant in Reference No. DOS-06-00037028-500, Revision 6, has no benchmarking analysis or validation provided that would indicate that the MORET4 code with the macroscopic cross-sections obtained from the APOLLO2 code is valid in this increased enrichment region. The validation provided should comply with the guidance in SSG-27, “Criticality Safety in the Handling of Fissile Material”, and ANSI/ANS-8.24-2017, “Validation of Neutron Transport Methods for Nuclear Criticality Safety.”

This information is needed to determine compliance with paragraphs 104(c), 501(c), 673, and 836(k)(iii) of IAEA SSR-6, 2012 Edition.

RAI-Cr-2 Provide justification in Reference No. DOS-06-00037028-503 to indicate that the weld analysis on the borated steel ring is applicable to the new TNF-XI content No. 8 at 20 wt% ^{235}U.

The referenced document was performed for the most limiting original contents at 5 wt% ^{235}U. The new enrichment limit requires justification that these welds have no significant impact on the criticality safety of the TNF-XI package with content No. 8 at 20 wt% ^{235}U.

This information is needed to determine compliance with paragraph 673(a)(ii) of IAEA SSR-6, 2012 Edition.

MATERIALS EVALUATION

RAI M-1 Provide appropriate references (e.g., material or design specifications, test reports, design or fabrication standards) to verify the following statements or conclusions in the application. If the reference document has already been provided to the NRC, then, identify the specific section/location in the application where the supporting information is provided.

a. Regarding the proprietary polyester-based Bora resin (neutron absorber material):

i) Chapter 0, Section 7.4, of the application states that the "workable" temperature range for the Bora material is -40 °C [-40 °F] and 150°C [302 °F]. In support of this conclusion, the applicant cited Reference No. 12986-R-08, Revision 2, "Transnucleaire Bora Resin Data Sheet", which does not appear to have been included in the application. The staff needs this information to verify the applicant's conclusion of adequate performance of the Bora material in the temperature range of interest per IAEA SSR-6 Regulations 501, 639, and 679. The applicant should ensure that the acceptable temperature range defined in the reference document is consistent with the chemical composition of the Bora material, as defined in Section 7.4 of the application.

ii) Chapter 0, Section 7.6, of the application states that the Bora neutron absorber resin is confined in stainless steel components in a dry environment. Therefore, the applicant concluded that corrosion is not credible in that encased environment. The applicant is asked to identify the design drawing that defines both (1) the material specification for the Bora material (per the chemical composition defined in Chapter 0, Section 7.4 of the application) and (2) the closure/encasing requirements for the Bora material in the stainless-steel component. The staff needs this information to verify the applicant's conclusion of adequate performance of the stainless-steel material adjacent to the Bora material per IAEA SSR-6 Regulation 501 and 614.

b. Regarding the phenolic resin (impact limiter/ fire retardant material):

i) Chapter 0, Section 7.4, of the application states that the phenolic foam has a “M1-F1” chlorine-free classification with a moisture content less than 20%. The applicant did not provide the reference for the “M1-F1” standard specification nor for the as-fabricated moisture content specification. The applicant also did not specify if the maximum moisture content is specified by weight, or by an alternate measure. The applicant is asked to provide the “M1-F1” standard specification, test results that demonstrate the expected residual water content, and the design drawing that defines the material specification for the phenolic resin material (per the chemical composition and allowable residual moisture defined in Chapter 0, Section 7.4 of the application). The staff needs this information to verify the assumed properties and fabrication standards for the phenolic resin per IAEA SSR-6 regulations 501, 614, and 640. If the references and design drawing are not provided, the staff may need to propose a condition for revalidation that requires compliance with Chapter 0, Section 7 of the application.

ii) Chapter 2, Appendix 4, of the application defines the chemical composition of the phenolic resin material at fabrication (i.e., carbon, hydrogen, and oxygen contents), which was used in the criticality safety analyses. However, per Chapter 0 of the application, the package design incorporated three types of phenolic resin. The application does not clearly identify that all three types of phenolic resin have the same chemical composition, and whether the material density is the only difference between the resin types. Further, the application does not provide the design drawing where the material specification requirements at fabrication for the three different types of phenolic resin are defined. The staff needs this information to verify the assumed properties and fabrication standards for the phenolic resin per IAEA SSR-6 Regulations 501, 614, and 640.

iii) Chapter 1, Section 2.1 of the application states that the phenolic foam can adequately perform within the temperature range of -200°C [-328 °F] to 120°C [248 °F]. In support of this statement, the applicant referenced Chapter 1, Appendix 2, “Phenolic Foam Test Report” (Reference No. 12986-Z-1-2, Revision 0, dated November 30, 2001), which only addresses the mechanical properties (i.e., compressive strength) of the phenolic foam (Type 1 and Type 2) at the low temperature requirement per IAEA SSR-6 regulations 639 and 679. The staff notes that the applicant did not justify adequate mechanical performance at temperatures as low as -200°C [-328°F], as discussed in the Chapter 1, Section 2.1, of the application; however, the staff recognizes that this justification is not necessary for compliance with IAEA SSR-6 regulations.

Although the applicant addressed the low-temperature mechanical performance of the phenolic resin, the applicant did not provide justification of adequate performance for the range of temperatures per IAEA SSR-6 regulations 639 and 679 (i.e., temperatures exceeding -40°C [-40 °F] up to 70°C [158 °F]). Per the discussion in Chapter 1, Appendices 1.1 and 1.2, this justification appears to be provided in either References 9 or 10 of Chapter 1 (i.e., Reference No. R&DDT001-26-B-2, Revision 1, "Synthèse d'essais de compression effectués en température sur des échantillons de mousse phénolique" or Reference No. NTC-05-00014263-000, Revision 0, "Note recapitulative sur le vieillissement en température des mousses phénoliques"). English translations of these references do not appear to have been included in the application. The staff needs this information to verify the applicant's conclusion of adequate performance of the phenolic resin material in the temperature range of interest per IAEA SSR-6 regulations 639 and 679.

In addition, Chapter 0, Section 4.3, of the application states that each upper plug protecting the primary lids contains two thermal insulating disks with phenolic foam which provide thermal insulation and shock absorption. Per Chapter 0, Table 0.2, the phenolic foam for these disks is Type 3, which has a lower density and lower compressive strength than Type 1 and Type 2 used elsewhere in the package. The application does not justify the mechanical properties in Chapter 0, Table 0.2, per test results or a standard specification that demonstrate that the assumed values in the structural evaluation are valid for temperature range of interest per IAEA SSR-6 regulations 639 and 679.

iv) Chapter 1, Section 2.1, of the application states that cracking of the phenolic resin was not observed in compression tests conducted at - 40°C [-40 °F]). The applicant referenced Chapter 1, Appendix 2, "Phenolic Foam Test Report" (Reference No. 12986-Z-1-2, Revision 0, dated November 30, 2001). The discussion in this reference does not appear to support this observation at the lowest temperature of interest per IAEA SSR-6 regulations 639 and 679.

c. Regarding ethylene propylene diene monomer (EPDM) material:

Chapter 1, Section 2.1, of the application states that the EPDM seal used for the primary containment lid (in each of the four containment wells inside the package) is an elastomer whose vitreous transition temperature is lower than – 40 °C [-40 °F] with adequate performance at temperatures higher than 75 °C [167 °F]. Further, Chapter 1, Section 7.4, defines hardness requirement for the EPDM seal and states adequate performance for an operating temperature range between – 40 °C [-40 °F] and 100 °C [212 °F]. The staff is unable to locate the appropriate references (e.g., material or design specification, test reports, design or

fabrication standards) that support these assertions and the adequacy of the mechanical properties for the temperature range of interest per IAEA SSR-6 regulations 639 and 679. If these references are not provided, the staff may need to propose a condition for revalidation that requires compliance with Chapter 0, Section 7, of the application.

d. Regarding the minimum boron-10 contents in the Bora neutron poison material and the borated steel material:

Chapter 0, Sections 7.3 and 7.4, of the application define minimum boron-10 requirements for both the borated steel material and the polyester-based Bora material, which were used in the criticality safety analyses. Drawing No. 12986-01, Revision K, does not identify these requirements. The applicant is asked to identify and provide the pertinent drawing(s), which identifies these acceptance requirements. If these drawings are not provided, the staff may need to include a condition for revalidation that requires compliance with Chapter 0, Section 7, of the application. The information is needed to ensure compliance with IAEA SSR-6 regulation 501.

The information is needed to ensure compliance with paragraphs 501, 614, 639, 640, and 679 of IAEA SSR-6, 2012 Edition.

RAI M-2 Provide appropriate references to support the thermal conductivities provided in the application for the various packaging materials.

Chapter 0, Table 0.2, of the application defines the thermal conductivities of the various packaging materials, used as input parameters in the thermal analyses in Chapter 2 of the application. Chapter 0 and Chapter 2 do not identify the appropriate references to support these values. The applicant needs to identify and provide these references to verify these values for the temperature range of interest.

This information is needed to determine compliance with paragraphs 639 and 679 of IAEA SSR-6, 2012 Edition.

RAI M-3 Provide design drawings that identify the weld requirements and non-destructive test requirements identified in Table 7A-1.1 of the application, per the safety categorization in Section 3 of Appendix 7A-1 of the application.

Drawing No. 12986-01, Revision K, does not identify weld requirements and non-destructive test requirements defined elsewhere in the application. Further, the “as-built” drawings of the qualification test specimens used for the drop and thermal tests, as provided in Chapter 1, Appendix 4, of the application, do not identify these requirements.

The staff recognizes that these requirements are individually identified in Chapter 0, Table 0.4 of the application. If the applicant chooses not to provide the design drawings with the appropriate weld and test requirements, the staff may need to

propose a condition for revalidation that requires compliance with Chapter 0, Table 0.4, of the application.

This information is needed to determine compliance with paragraph 501 of IAEA SSR-6, 2012 Edition.

RAI M-4 Provide an evaluation to support the conclusion that flammable gas generation due to radiolysis in the package is negligible.

Chapter 0A, Section 3.1, of the application states that there is no risk of radiolysis in the package as the thermal power of Contents No. 8 is negligible. The applicant's conclusion is not supported by a bounding evaluation. The staff needs this information to ensure that generation of flammable gases due to radiolysis is not credible.

This information is needed to determine compliance with paragraphs 501, 614, and 644 of IAEA SSR-6, 2012 Edition.

STRUCTURAL EVALUATION

RAI-St-1 Clarify the change bars located in Chapter 1 of the TNF-X1 SAR, Revision 9, and their relationship to the new proposed content No. 8.

In Chapter 1 of the TNF-XI SAR, Revision 9, located in Enclosure 6 of Transmittal Letter E-51440, a number of change bars are found throughout the chapter. These change bars are not identified as part of the "List of Changes" located in Enclosure 5 of the same letter. The change bars appear to be related, in part, to updates in the drop test evaluation of the primary lid.

This information is needed to determine compliance with paragraphs 220, 722 and 727 of SSR6 of IAEA SSR-6, 2012 Edition.

RAI-St-2 Provide the criteria used to select which of the two primary lid designs will be used.

In SAR Chapter 1, Appendix 1-8, the applicant refers to two primary lid designs. On the first one, the bayonets are machined with the primary lid. On the second one, the bayonets are welded to the primary lid. The latter is labeled as Option 1. In the same appendix, the applicant refers to Chapter 0 for additional descriptions. The staff reviewed the aforementioned Chapter 0 and attached Drawing 12986-01 and could not find any information related to the criteria or conditions for the use of each design.

This information is needed to determine compliance with paragraphs 220 and 727 of SSR6 of IAEA SSR-6, 2012 Edition.

RAI-St-3 Provide and justify the criteria and assumptions used to perform the analysis in Appendix 1-8. Also, explain how the criteria and assumptions are conservative.

In Appendix 1-8, the applicant discusses a simplified model to evaluate the “good mechanical behavior of the primary lid during the 9-meter drop test considering the most penalizing off-centering of the content.” The following information is not entirely clear to the staff:

a. Accelerations of 300 g and 500 g were used to validate the analysis. The staff was unable to accurately determine the criteria used to select these acceleration values.

b. Figure 2 of Appendix 1-8 illustrates a top-down drop onto the primary lid. The applicant did not justify how this was the governing drop orientation.

c. In Appendix 1-8, section 3.1, the applicant states the following:

> “…study is only dealing with the mechanical strength of the primary lid under imposed acceleration”
>
> and describes characteristics of the simplified model. The staff was unable to find sufficient justification within the application that supports the use of a simplified model.

This information is needed to determine compliance with paragraph 727 of IAEA SSR-6, 2012 Edition.