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

February 8, 2021

Mr. Richard W. Boyle
Radioactive Materials Branch
U.S. Department of Transportation
1200 New Jersey Avenue SE
Washington, D.C. 20590

SUBJECT: REQUEST FOR REVALIDATION OF JAPANESE CERTIFICATE OF APPROVAL J/170/B(U)F-96 FOR THE JRF-90Y-950K PACKAGE – REQUEST FOR ADDITIONAL INFORMATION, DOCKET 71-3036

Dear Mr. Boyle:

By letter dated October 1, 2020 (Agencywide Documents Access and Management System Accession No. ML21033A636), the U.S. Department of Transportation requested that the U.S. Nuclear Regulatory Commission staff perform a review of the Japanese Certificate of Approval J/170/B(U)F-96, for the Model No. JRF-90Y-950K 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. This letter is to advise you that the information needed to continue our review is described as a request for additional information in the enclosure to this letter. Addressing the request for additional information does not preclude the staff from issuing further requests for additional information during the detailed technical review of this application.

In order to complete our technical review on schedule, your response should be provided by February 15, 2021. If you have any questions regarding this matter, I may be contacted at (301) 415-5196.

Sincerely,

/RA/

Nishka Devaser

Nishka Devaser, Project Manager
Storage and Transportation Licensing Branch
Division of Fuel Management
Office of Nuclear Material Safety
and Safeguards

Docket No. 71-3036
EPID L-2020-DOT-0000

Enclosure:
Request for Additional Information

SUBJECT: REQUEST FOR REVALIDATION OF JAPANESE CERTIFICATE OF APPROVAL J/170/B(U)F-96 FOR THE JRF-90Y-950K PACKAGE – REQUEST FOR ADDITIONAL INFORMATION, DOCKET 71-3036,

DATE: February 8, 2021

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Request for Additional Information
Docket No. 71-3036
Model No. JRF-90Y-950K Package
Japanese Certificate J/2027/AF-96

By letter dated October 1, 2020 (Agencywide Documents Access and Management System Accession No. ML21033A636), the U.S. Department of Transportation requested that the U.S. Nuclear Regulatory Commission staff perform a review of the Japanese Certificate of Approval J/170/B(U)F-96 and associated safety analysis report (SAR), for the Model No. JRF-90Y-950K transport package and make a recommendation concerning the revalidation of the package for import and export use.

This request for additional information identifies information needed by the NRC staff (the staff) in connection with its technical review of the Model No. JRF-90Y-950K package application.

Chapter 6 – Criticality Safety Evaluation

RAI 6-1. Revise the application to specify the thickness, including tolerance, of the rectangular stainless steel pipes that make up the fuel basket.

The staff needs this dimension in order to perform confirmatory criticality calculations for the package design. This dimension does not appear in the general arrangement drawings or description of the packaging in SAR Section C.

This information is needed for the staff to confirm that the package design will meet the criticality safety requirements in paragraph 673 of IAEA SSR-6, "Regulations for the Safe Transport of Radioactive Material."

RAI 6-2. Revise the application to demonstrate that content loads less than the maximum requested will remain subcritical.

SAR Table A.1 states that the number of Kyoto University Critical Assembly (KUCA) fuel elements is 1,200 or less for coupon elements, and 300 or less for flat elements. However, the criticality analysis only demonstrates that the maximum load for each element type is subcritical. Lower numbers of elements may allow for greater spacing between elements with a more optimum degree of moderation, and therefore a higher system k_{eff}. Initial staff confirmatory analyses indicate that k-effective (k_{eff}) is higher for lower numbers of plates at an optimized pitch. The analysis in the SAR should demonstrate that all allowable content loads, up to the maximum requested, remain subcritical under all conditions.

This information is needed for the staff to confirm that the package design will meet the criticality safety requirements in paragraph 673 of IAEA SSR-6, "Regulations for the Safe Transport of Radioactive Material."

RAI 6-3. Revise the criticality analysis to consider hydrogen-bearing material other than water that may be present in the package with the fissile material contents.

SAR Section D.3 states that KUCA fuel contents are “wrapped by some buffer such as polyurethane foam,” and that “silicone rubber spacers are used to the upper and lower sides of the fuel plates in order to absorb possible impact energy during transport, and also to fix the fuel plates.” The criticality analysis in SAR Section E only considers water as a possible moderator. The hydrogen-bearing materials discussed in Section D.3 can have a higher hydrogen density than water for a given mass and may be more effective moderators than water. The criticality analysis should be revised to consider the moderating effects of these materials, including consideration of any reconfiguration of the materials under accident conditions (e.g., melting).

This information is needed for the staff to confirm that the package design will meet the criticality safety requirements in paragraph 673 of IAEA SSR-6, “Regulations for the Safe Transport of Radioactive Material.”

RAI 6-4. Revise the application to provide a validation of the calculational method used to determine system k_{eff} consistent with the recommendations in IAEA SSG-26, “Advisory Material for the IAEA Regulations for the Safe Transport of Radioactive Material.”

Although SAR Section E.5 provides some analyses performed as part of a “benchmark test,” there are several omissions and needed corrections in the evaluation based on the available guidance in IAEA SSG-26 Appendix VI, “Criticality Safety Assessments,” specifically paragraphs VI.22 through VI.39:

1. The benchmark test in the SAR was performed using a different code and cross section library than used to establish criticality safety in the SAR (KENO V.a and the 137 group MGCL cross section library are used in the benchmark test in SAR Section E.5, while SCALE 5.1/KENO VI and the 238 group ENDF/B-V cross section library are used in the criticality safety assessment). The same computational method must be used consistently between the validation cases and the safety analysis cases to confirm that the bias and bias uncertainty determined in the validation are applicable to the safety evaluation being performed.

2. The applicant did not determine a bias and bias uncertainty based on the results of benchmark evaluations, per the recommendation of paragraph VI.23(a) of IAEA SSG-26. Note that the k_{eff} values for evaluated critical experiments from Table E.9 show that the code and cross section library used in the benchmark evaluation underpredict k_{eff}, on average, by greater than 1%. The calculated bias and bias uncertainty should be added to the calculated system k_{eff} to demonstrate that total system k_{eff} is less than 0.95, per the recommendations of IAEA SSG-26, paragraph VI.35.

3. The applicant did not establish a range of applicability for the benchmark analysis, including any calculated bias and bias uncertainty, based on the range of parameter variation (e.g., enrichment, hydrogen to fissile ratio (H/X), energy of the average lethargy causing fission (EALF)) in the

selected experiments and did not show the analysis for the package with KUCA fuel is within the ranges of applicability for these parameters.

4. The applicant did not demonstrate that the selected critical experiments have parameters (e.g., materials, geometry) that are characteristic of the package design. Note that some critical experiment parameters differ significantly from the package design (e.g., enrichment for the JAEA TCA criticality experiment (2.6 weight percent ^{235}U) and the ORNL International benchmark test (>93 weight percent ^{235}U) versus 19.95 weight percent for the KUCA fuel per the certificate).

5. The applicant did not evaluate the benchmark results to determine trends that may exist against parameters important in the validation process (e.g., enrichment, H/X, EALF).

This information is needed for the staff to confirm that the package design will meet the criticality safety requirements in paragraph 673 of IAEA SSR-6, “Regulations for the Safe Transport of Radioactive Material.”