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

July 10, 2020

Mr. Wren Fowler
Licensing Manager
NAC International
3930 East Jones Bridge Road
Suite 200
Norcross, GA 30092

SUBJECT: APPLICATION FOR THE MODEL NO. NAC-LWT, AMENDMENT NO. 70 OF CERTIFICATE OF COMPLIANCE NO. 9225 – REQUEST FOR ADDITIONAL INFORMATION

Dear Mr. Fowler:

By application dated March 24, 2020 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML20087M175), NAC International, submitted an application for amendment to Certificate of Compliance No. 9225 for the Model No. NAC-LWT package.

In connection with our review, we need the information identified in the enclosure to this letter. Additional information requested by this letter should be submitted in the form of revised pages. Please provide your response within two months from the date of this letter.

Please reference Docket No. 71-9225 and Enterprise Project Identifier No. L-2020-LLA-0056 in future correspondence related to this request. The staff is available to meet to discuss your proposed responses. If you have any questions, I may be contacted at (301) 415-5196.

Sincerely,

Nishka Devaser **/RA/**

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

Docket No. 71-9225
EPID No. L-2020-LLA-0056

Enclosure:
Request for Additional Information

APPLICATION FOR THE MODEL NO. NAC-STC, AMENDMENT NO. 70 OF CERTIFICATE OF COMPLIANCE NO. 9225 – REQUEST FOR ADDITIONAL INFORMATION

DATE: July 10, 2020

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Request for Additional Information
Docket No. 71-9225
Model No. NAC-LWT Package
Certificate of Compliance No. 9225
Revision No. 70

By application dated March 24, 2020 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML20087M175), NAC International submitted an application for amendment to Certificate of Compliance No. 9225 for the Model No. NAC-LWT package. This request for additional information identifies information needed by the U.S. Nuclear Regulatory Commission staff (the staff) in connection with its review of the application. The staff used guidance provided in NUREG-1609, "Standard Review Plan for Transportation Packages for Radioactive Material," in its review of the application.

The questions below describe information needed by the staff to complete its review of the application and to determine whether the applicant has demonstrated compliance with regulatory requirements.

Structural Evaluation

1-1. Clarify the size of the fillet weld used to join the plug cap to the National Research Universal/ National Research Experimental (NRU/NRX) tube and provide supporting calculations.

Sheet 1 of Drawing 175 shows the plug cap (bill of materials [BOM] part 5) joined to the plug tube (BOM part 4) by a fillet weld of unspecified weld size. The plug cap weld is needed to maintain small fragments within the NRU/NRX caddy and will be subjected to loading during drop tests, vibration, etc., for normal conditions of transport (NCT) and hypothetical accident conditions (HAC). It appears that supporting calculations demonstrating the weld's ability to retain the plug cap during NCT and HAC have not been provided.

This information is needed to meet the requirements of Title 10 of the *Code of Federal Regulations* (10 CFR), Paragraphs: 71.71(c)(5), 71.71(c)(7), 71.73(c)(1), and 71.73(c)(3).

1-2. Clarify how the plug assembly will remain attached to the NRU/NRX tube during NCT and HAC conditions and provide supporting calculations/details.

Sheet 1 of Drawing 175 depicts the plug (BOM part 6) which is assumed to be attached to the tube (BOM part 1) in an unknown fashion. The plug is needed to maintain small fragments of material when carrying enriched fast neutron (EFN) rods, moly targets, or booster rods within the NRU/NRX caddy. However, the diameter of the plug tube is unspecified (flag note 4) and it is unclear how the plug assembly will remain attached to a tube (which has an unspecified diameter) during NCT and HAC.

This information is needed to meet the requirements of 10 CFR 71.71(c)(5), 71.71(c)(7), 71.73(c)(1), and 71.73(c)(3).

1-3. Clarify the basis for cladding damage limitations on EFN rods and how they will be measured and/or ensured when NRU/NRX caddies are carrying EFN rods.

Page 1-9 of the application states in part *"…Therefore, there are no cladding damage limits except for full cask loads of EFN rods which require the equivalent of 30% clad (fueled surface area).*". It appears that calculations supporting this value/assessment have not been provided, so it is unclear how the cladding will perform for NCT and HAC with these damage limits. In addition, it is unclear from this description if damage is limited to 30% of the cladding surface area or if only 30% of the cladding surface needs to be intact. In addition, it is unclear how this value will be ascertained, measured, or otherwise verified.

This information is needed to meet the requirements of 10 CFR 71.71(c)(5), 71.71(c)(7), 71.73(c)(1), and 71.73(c)(3).

Materials Evaluation

2-1. Provide information on temperature and radiation level inside the package resulting from the new contents of the package.

The applicant provided the heat loading and temperature effects in Safety Analysis Report (SAR) Pages 195 – 196, without presenting any potential temperature changes resulting from the new contents. The information provided was from the previous SAR revision. The staff needs to confirm that temperature values are acceptable for the new contents. The temperature is important to assess the stability of seals, O-ring and aluminum. Similarly, the applicant did not provide any information on the change in radiation level(s) resulting from the new package contents. The staff needs the changes in radiation level(s) to assess the material stability of the seals and O-ring.

This information is needed to meet the requirements of 10 CFR 71.31.

Shielding Evaluation

3-1. Explain what is meant by a limited amount of cladding integrity being credited for full basket loads of EFN rods, why this was done, and how this limitation could affect the shielding evaluation of the package since no radiation level (or dose rate) analysis was performed for this amendment. Also explain how limits on cladding and content integrity (or lack thereof) affect the physical distribution of all the proposed contents' sources within the package and how the shielding evaluation accounts for this physical distribution and changes to it.

SAR Page 1-9 states in part "…*Therefore, there are no cladding damage limits except for full cask loads of EFN rods which require the equivalent of 30% clad (fueled surface area).*" It is unclear what this statement means in terms of the physical condition of the contents (the rod integrity under normal and hypothetical accident conditions) and the physical distribution of the source within the package. It is also not clear how the shielding evaluations account for the potential source distributions for the allowed cladding damage for the EFN rods and the allowed damage or physical conditions of the other proposed contents.

This information is needed to meet the requirements of 10 CFR 71.47 and 71.51.

3-2. Confirm whether the caddy plugs are always used with the proposed contents.

Based on the staff's understanding of the descriptions of the contents and the shielding evaluation, it would seem that the caddies should always be used with the proposed contents and that this should be specified in the package operations section of the application.

This information is needed to meet the requirements of 10 CFR 71.47, 71.51 and 71.87.

3-3. Explain what is meant by no caddy being credited in the shielding evaluation. Confirm whether this means that none of its materials were credited and that its ability to retain the rods/contents within any set geometric volume was also not credited.

In Section 4.1 of the application, the applicant stated that no caddy was credited in the evaluation of bounding dose rates for the NRU-HEU contents. However, there are no details on how this evaluation was done.

This information is needed to meet the requirements of 10 CFR 71.47 and 71.51.

Criticality Evaluation

4-1. Provide the maximum allowed U-235 enrichment for each of the proposed new contents.

The applicant provided specifications for the proposed new contents in Table 1-1 of the calculation package, "50055-5001 Rev. 0," however, the table only contains the minimum enrichment as "Enrichment(%) – Min". There is no maximum allowable enrichment limit for the proposed contents. Because enrichment is an imperative parameter for criticality safety of U-235 based fissile materials, all packages must include a maximum allowable U-235 enrichment for fissile material contents in accordance with the regulatory requirements of 10 CFR 71.55 (b) "Except as provided in paragraph (c) or (g) of this section, a package used for the shipment of fissile material must be so designed and constructed and its contents so limited that it would be subcritical…" The staff will revise the content specification table in Certificate of Compliance, Condition 5.(b)(1)(xxii) to reflect the revised definition of the fissile material contents.

The staff needs this information in order to determine if the package with the proposed contents meets the regulatory requirements of 10 CFR 71.55.

4-2. Demonstrate that the k_{eff} of the NAC-LWT package with the mixed load of NRU/EFN (National Research University/Enriched Fast Neutron) rods and six Moly targets in the caddies is below the upper subcritical limit (USL).

Page 6.7.6-5 of the application states: "*Previous analysis demonstrated that a cask loaded of NRU/EFN rods in caddies produces k_{eff} values above the USL when assuming unclad materials. The analysis also demonstrated that a configuration with the six interior basket tubes empty is significantly below the USL. Rather than leaving the interior locations empty the low fissile mass Moly targets are placed into the inner 6 tubes. With a fissile mass of the bounding Moly caddy (containing Double Length Moly targets) being <20% that of the NRU caddy, <u>engineering judgement indicates that results will be below the USL</u>*." The staff's concern is that this engineering judgment may not be reliable because replacing the six empty tubes with highly enriched Moly targets will

impact on the reactivity of the package in two key aspects: (1) increased quantity of fissile material and (2) removal of the neutron flux trap formed by the empty tubes. Criticality safety of the package with this proposed loading configuration is a concern because the package fully loaded with the NRU/EFN rods has been shown by the applicant to exceed the USL.

The staff needs this information to determine if the package with the proposed contents meets the regulatory requirements of 10 CFR 71.55(b), 71.55(d), and 71.55(e).

4-3. Provide justification for the applicability of the selected critical experiments for code benchmarking or revise the code benchmarking to use critical experiments that are more appropriate for this application.

The applicant performed benchmarking analyses for the MCNP computer code used to perform criticality safety analyses. In Table 6.5.6-1 of the application, the applicant provided a list of the 169 critical experiments it selected for code benchmarking. The staff notes that of these selected critical experiments, 18 of them are rods with U-235 enrichment around 79% and arranged in various sizes of hexagonal arrays, 47 of them are rods with U-235 enrichment of around 79% and arranged in various sizes of square arrays, 97 are plates with 93% U-235 enrichment and arranged in various square arrays, six of them are rods with 17% U-235 enrichment and arranged in various hexagonal arrays, and one is a 360 plate array at 19.77% enrichment. Since the Booster rods, EFN rods, and Mo-99 targets are all at 91% enrichment, in solid rod shape, and they will form approximate hexagonal geometry arrays when loaded into the caddies, it is not clear if the majority of the selected critical experiments are applicable to this application, particularly those experiments with plate shape fuel in square arrays and those with low U-235 enrichment. As such, there is a concern that the bias and bias uncertainty determined using those selected critical experiments may be skewed and not appropriate for the criticality analysis for the package with the proposed contents.

The staff needs this information to determine if the package with the proposed contents meets the regulatory requirements of 10 CFR 71.55(b), 71.55(d), and 71.55(e).

Package Operations Evaluation

5-1. Pending resolution to RAI 4-2, revise step 21 of the operating procedures to either disallow mixed loading of the NRU/EFN rods and Moly targets in the same basket or to indicate that the Moly targets can only be loaded into the six interior locations of the fuel basket.

The applicant provided revised operating procedures for loading of the proposed new contents. In step 21, the applicant added a note stating: “EFN rods and Moly targets may be loaded in the same basket, but Booster rods shall not be loaded in the same basket as either EFN rods or Moly targets,” however, this kind of mixed loading has not been analyzed to demonstrate it is safe to do so with respect to criticality safety (see RAI 4-2). Therefore, this operating procedure needs to be revised. If the response to RAI 4-2 cannot demonstrate it is safe to do so, the applicant should remove the note to Operating Procedure Step 21. If new analyses demonstrate that it is safe to allow mixed loading of EFN rods and Moly targets with six Moly targets in the interior locations of the fuel basket, the applicant needs to revise the operating procedures to clearly state that only six Moly targets can be loaded with EFN rods and the six Moly target rods must be loaded only in the interior locations of the fuel basket.

The staff needs this information to determine if the package with the proposed contents meets the regulatory requirements of 10 CFR 71.55(b), 71.55(d), 71.55(e), and 71.87.