Non-Proprietary Request for Additional Information
NAC International
Docket No. 71-9225
Certificate of Compliance No. 9225
Model No. NAC-LWT Package

By application dated December 31, 2013, NAC International (NAC) requested an amendment to Certificate of Compliance (CoC) No. 9225 for the Model No. NAC-LWT package. The applicant requested that the certificate be revised to add new MTR fuel parameters, including U-235 content and maximum decay heat limit per element. This request for additional information identifies information needed by the U.S. Nuclear Regulatory Commission staff in connection with its review of the application. The requested information is listed by chapter number and title in the applicant's safety analysis report (SAR). NUREG-1609, "Standard Review Plan for Transportation Packages for Radioactive Materials," was used by the staff in its review of the application.

Each question describes information needed by the staff for it to complete its review of the application and to determine whether the applicant has demonstrated compliance with regulatory requirements.

SHIELDING

1. Justify that the current analyses support the proposed change of the U-235 mass per element for all MTR element types covered in the proposed CoC Condition No. 5(b)(1)(iv)(c) table.

   The CoC table includes MTR fuel element types with different characteristics (e.g., different active fuel widths and plate thicknesses), and the applicant proposes to change the maximum U-235 mass per element specification for all the element types in the table. The analyses provided in the application only appear to be applicable to one or fewer of the MTR fuel element types included in the CoC table. Thus, it is not clear that the analyses in the application support a change to the maximum U-235 mass per element limit for all the MTR element types covered by the listed CoC table.

   This information is needed to verify compliance with 10 CFR 71.35.

2. Justify that the MTR element properties used in the shielding analysis result in a bounding source term for the proposed contents. Justify that the dose rate comparison between the proposed contents and the allowable HEU contents is for bounding cases for both the proposed contents and the HEU contents.

   It is not clear from the application that the element properties for the proposed contents result in bounding dose rates for those contents. Nor is it clear that the HEU dose rates compared with those of the proposed contents are for HEU element properties that result in bounding HEU dose rates. The application should address the effects of active fuel width, fuel thickness, plate thickness, active fuel height, fuel composition (i.e., U-Al vs. the other compositions described in the application), enrichment, U-235 mass per plate, number of plates, U-235 mass per element, and position along the proposed decay heat loading curves (burnup and cooling time combinations).

This information is needed to verify compliance with 10 CFR 71.47 and 71.51.

3. Provide the following information regarding the shielding analysis:
   a. Confirm that the shielding analysis does not credit the presence of impact limiters in any way (i.e., axial surface dose rates are on the surface of the cask lid) otherwise clarify the analysis descriptions and justify, particularly for HAC, including the impact limiters.
   b. Confirm that the MTR elements are positioned at the top of the cask cavity (i.e., touching the cask lid), or justify the position of the elements in the model.
   c. See Enclosure 1.
   d. Confirm that the SAS4 model does not contain any boron in the neutron shield (see Table 5.3.4-8) of the application.

   The descriptions of the analysis, including figures and tables, regarding the analysis models are not clear or appear to be inconsistent. For item b, if the elements are able to move in the axial direction, the model should place the elements in the position that maximizes dose rates. For item c, see Enclosure 1.

   This information is needed to verify compliance with 10 CFR 71.35, 71.47, and 71.51.

4. See Enclosure 1.

5. Explain and justify how lead slump was addressed in the HAC models for MTR fuel.

   It is not clear from the application that lead slump was addressed in the HAC shielding analysis models for the MTR contents. The analysis should account for this slump in a way that is supported by, or conservative versus, the structural analysis for lead slump.

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

6. Provide descriptions of the conveyance, ISO container and personnel barrier and the assumptions regarding these items that are relied on for the shielding analysis. Also, include the dose rates for all relevant locations, as specified in the regulations for the type of transport assumed in the analysis.

   The application, including the shielding analysis, mentions the conveyance and the use of an ISO container or a personnel barrier. However, there is no description of these items. In particular for the shielding analysis, the configuration of the package with respect to the conveyance, the ISO container, and the personnel barrier needs to be described. This includes the distances, both axial and radial, from the package to the ISO container, personnel barrier, and conveyance surfaces assumed in the analysis. The staff understands that a personnel barrier may be used instead of an ISO container; thus, the analysis should determine the dose rates that are bounding for use of either of these items. It is also not clear that the dose rates for all locations were addressed. For example, the surface and 2 meter dose rate limits apply to all four directions (i.e., radial and axial directions) from the package, the ISO container (or personnel barrier) and the conveyance for exclusive-use transportation. The analysis in the application only addresses dose rates at 2 meters from the package's radial side and at the cab location. The analysis also needs to show the dose rates comply with the 2 meter limits at the axial ends of the package as well.

   This information is needed to verify compliance with 10 CFR 71.47 and 71.51.

7. See Enclosure 1.

8. Include the limit of U-235 mass per element together with the U-235 mass per plate limit in the operations descriptions in Chapter 7 of the application and the proposed CoC No. condition 5(b)(2)(iv) regarding the contents limits.

   Both the mass per plate and the mass per element limits must be satisfied for the element to be acceptable. The analyses do not support relying on only one limit or the other to define the acceptable MTR contents. For example, the shielding analysis uses the mass per element limit. An element with 23 plates at the maximum mass per plate, would have a U-235 content that exceeds that mass per element limit.

   This information is needed to verify compliance with 10 CFR 71.87.

9. Modify Section 7.1.5.4 of the application to:
   a. Add a statement to the end of the first paragraph to explicitly state that elements above the curve in the respective figures are acceptable, but those below the curve are not.
   b. Correct the figure reference in LEU MTR #1.
   c. Modify the LEU MTR procedures to address elements in the 10 to 20 watt range (these elements aren't covered by the current text). The procedures should be clear that elements below or beyond the end of the 10 watt curve and above the 20 watt curve are loaded as 20 watt elements.
   d. Add the element mass limit for U-235 to the MTR LEU procedures; both the plate and the element mass limits must be met.

   These modifications are needed to ensure the package operations are consistent with the package analyses and the operations are clear.

   This information is needed to verify compliance with 10 CFR 71.87.

10. Address the uncertainties associated with using the figures in Chapter 7 to determine the allowable contents, and the contents heat load. Also clarify how the package operations descriptions in Chapter 7 ensure the minimum cooling time of 90 days and the maximum burnup limits for MTR fuel, such as 139.3 GWd/MTU for 40W LEU fuel, are met.

    The procedures for determining whether an MTR element is allowed to be loaded into the package and the elements heat load rely on interpreting decay time vs. burnup curves (e.g., Fig. 7.1-2~7,12,13). The scales of these curves is quite large, introducing uncertainties into the determination with impacts on both heat load and dose rates, particularly for elements on or near the curve. The uncertainties should be evaluated and accounted for, as appropriate, in the package analyses. The scale of the figures and the lack of a statement of the minimum cooling time and maximum burnup limits elsewhere in Chapter 7 of the application also make it unclear that the minimum 90 day cooling time and the maximum burnups of the MTR elements (e.g., 139.3 GWd/MTU for 40W LEU fuel) will be met.

    This information is needed to verify compliance with 10 CFR 71.47, 71.51, and 71.87.

11. Justify the apparent extension of some of the curves in the Chapter 7 figures for determining the acceptability of fuel elements for shipment.

The curves in at least some of the figures in Chapter 7 (e.g., Figs. 7.1-4, 6, 7, 12) appear to have been extended beyond their currently approved form. No analysis was provided to support this extension.

This information is needed to verify compliance with 10 CFR 71.47, 71.51, and 71.87.

12. Modify Section 7.1.4 of the application to be consistent with the request, as supported by the analyses.

    There is information in this section that is affected by the proposed changes. For example, the element and plate mass limits in #15 on page 7.1-16 need to be updated.

    This information is needed to verify compliance with 10 CFR 71.87.

13. Address the following, modifying the application as needed:

    a. Confirm the 1 wt% boron content requirement for the neutron shield. The CoC states the neutron shield contains 1 wt% boron; however, the neutron shield specification in the drawings (315-40-02, Sht. 1 of 2) appears to result in a boron concentration that is much less than this concentration.
    b. Clarify the weight of the MTR elements. Table 1.2-4 indicates 30 lbs while Table 5.1.1-2 says 13 lbs.
    c. Explain the change to the maximum uranium mass values in Table 1.2-4. The 2.474 max kg U/element value for LEU MTR was deleted from this table; however, it is still in Table 5.1.1-2. The basis for the change is not clear.
    d. Explain why note 4 of Table 1.2-4 is not part of the proposed CoC content conditions for MTR fuel. It appears it should be.
    e. Correct the discussions of the maximum LEU MTR burnup to state the value is 139.3 GWd/MTU, which is the analyzed value (not the 140 GWd/MTU stated on page 5.3.4-3 of the application).
    f. Correct the table references on page 5.3.4-3 of the application. The currently referenced tables do not show the information discussed where these tables are referenced.
    g. Modify Figure 5.3.4-8 and/or the statement on page 5.3.4-2 that HEU cases bound MEU dose rates. The current Figure 5.3.4-8 does not support that statement. In addition, the figure also appears to conflict with the note at the bottom of Table 5.3.4-9. Modify, as necessary, the evaluations and conclusions that are based on the figure and its underlying analysis.
    h. Ensure the correct regulatory limits are referenced in Section 7.3, in the note for step 3. If the objective of Section 7.3 is to ship an unloaded package as an empty package, as it would qualify in that regard per DOT requirements, the note in step 3 should refer to 49 CFR 173.428 vs. the current regulatory references.

    This information is needed to verify compliance with 10 CFR 71.47, 71.51, and 71.87.

CRITICALITY

1. Clarify the intended content and provide appropriate criticality safety analysis to support this amendment request.

   The application states that the amendment request is to allow up to 23.5 grams of U-235 per MTR plate and 23 plates per fuel element or 23 elements per fuel basket for loose

plates and a maximum weight of 490 grams of U-235 per element or basket. The staff observed that these numbers do not match, i.e., 23 x 23.5 (grams) = 540.5 grams, the total weight of U-235 exceeds the 490 grams per fuel element/basket limit. Yet even with the lowest U-235 load per plate, the total uranium-235 load exceeds the 490 grams per element limit. The intended content should be clarified and the criticality safety analysis revised if necessary.

This information is needed to verify compliance with10 CFR 71.55.

2. Review and justify or correct the statement on page 6.4.3-13.

Page 6.4.3-13 of the safety analysis report states: "Section 6.4.3.12 has demonstrated an active fuel width of 7.3 cm yields a k_s of greater than 0.95." This appears to be a typographical error and that the intended meaning is: "Section 6.4.3.12 has demonstrated an active fuel width of 7.3 cm yields a k_s of **NOT** greater than 0.95."

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