NRC FORM 699
(05-2012)

U.S. NUCLEAR REGULATORY COMMISSION

CONVERSATION RECORD

DATE: 12/05/2012

TIME: 10 : 00 ☑ AM ☐ PM

NAME OF PERSON(S) CONTACTED OR IN CONTACT WITH YOU: Anthony Patko, et. al.

TELEPHONE NO.: (678) 328-1274

E-MAIL ADDRESS: tpatko@nacintl.com

ORGANIZATION: NAC International

SUBJECT: Discussion on 12/5/12 of preliminary questions for the amendment to add NRU/NRX fuel as authorized contents to Certificate of Compliance No. 9225, for the Model No. NAC-LWT package

TYPE OF CONVERSATION
- ☐ IN-PERSON
- ☐ E-MAIL
- ☑ TELEPHONE
- ☐ INCOMING
- ☑ OUTGOING

SUMMARY

NRC participants:
Alexis Sotomayor-Rivera
Veronica Wilson
Bernard White

NAC International Participants:
Anthony Patko
Holger Pfifer
Michael Yaksh
Wren Fowler

NRC used the phone call to provide its preliminary thermal, criticality, and shielding questions on the subject amendment to NAC International. The complete set of questions will be provided to NAC via letter by the end of calendar year 2012.

Thermal:
Provide the supporting thermal ANSYS input files that support the results given within the SAR.

Staff reviewed "Chapter 3: Thermal Evaluation" of the SAR. Within staff's review, staff viewed the thermal results generated from a set of ANSYS files. Provide these thermal ANSYS input used within the analysis, in order for staff to confirm that the results meet the limits listed in the regulations for both normal condition of transport and hypothetical accident conditions.

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ACTION REQUIRED

NRC will follow-up the call with a letter transmitting the complete set of questions to NAC.

NAME OF PERSON DOCUMENTING CONVERSATION	SIGNATURE	DATE
Bernard White	Bernard White IV	1/4/13

ACTION TAKEN

TITLE OF PERSON TAKING ACTION	SIGNATURE OF PERSON TAKING ACTION	DATE

SUMMARY:
Shielding:

Clarify whether these contents are shipped in an enclosed vehicle. Table 5.3.20-20 in the application dated October 26, 2012, shows a maximum dose rate on the side surface of the transportation package to be 313.3 mrem/hour, which is above the limit of 200 mrem/hr to an open vehicle.

Criticality:

1. Provide the conditions under which each analysis in Table 6.7.2-6 in the application is performed. Include details for: fuel type, enrichment, moderation inside the tubes, moderation inside the basket (outside the tubes), condition/presence of cask outer shell, lead shield and neutron shield.

2. The criticality evaluation of the infinite array after the tests for normal conditions of transport has a keff of only 0.07690. Please explain why this value is so much lower than that of the single cask under normal conditions of transport (0.92525). Section 6.7.2.8 says: "Normal conditions are based on an infinite array of packages, square array / touching casks, with a dry cask interior with optimum moderator between casks. Both full density moderator and void were evaluated between casks, and the maximum reactivity is achieved by the array having a dry exterior," Section 6.7.2.7 says: "the most reactive case is reevaluated by removing the lead and outer shells (including neutron shield), and reflecting the system by water at full density on the X, Y, and Z faces." Why is it more conservative to reflect the system by water at full density for a single cask evaluation but not so for the array? Does the single cask have a dry cask interior? Is this dry inside the fuel tubes or just between the fuel tubes? Justify that the configuration chosen is the most conservative.

3. Clarify whether the NRU/NRX fuel can be mixed in a single package loading. If so, justify that a mixed loading is bounded by the submitted analyses.

4. Section 6.7.2.2 says "The models are analyzed separately under normal conditions and hypothetical accident conditions to ensure that all possible configurations are subcritical." Clarify the differences between the models for normal conditions of transport and HAC.

5. Section 6.7.2.3 says the payload was most reactive when assuming loss of the neutron shield. Is this an assumption made for all calculations shown in Table 6.7.2-6 after the tests for normal conditions of transport and hypothetical accident conditions? Provide justification for this assumption. The staff finds that there are competing reactivity effects, since there is boron present in the neutron shield, this may reduce the reactivity, however the neutron shield also provides neutron reflection which may increase the reactivity.

6. Section 6.7.2.2 states that the criticality evaluations were performed using the MCNP5 code package. Clarify if this is MCNP5 version 1.60 or MCNP5 version 1.30.

7. Provide a representative output file for the criticality calculations that gives the maximum keff.

8. In discussing the low enriched NRU fuel, Section 6.7.2.6 says that "the most reactive configuration of rod sections was re-evaluated. The low enriched NRU fuel results in a keff + 2σ of 0.89508, compared to 0.92560 for the high enriched fuel." Considering the difference in fuel material and enrichment, the rod configuration and moderation that give the maximum reactivity could be different than that of the high enriched fuel. Provide additional details on how the maximum reactivity of the low enriched fuel was determined.

9. Section 6.7.2.3 says that the payload is most reactive with flooded cask cavity and exterior, then Section 6.7.2.4 says (1st paragraph) "The most reactive configuration for both fuel types is a system where the tube is fully flooded at maximum density water while the cask cavity is dry." Then later in 6.7.2.4 it says: "Most reactive condition switches to a wet cask cavity for NRX fuel when considering a radial out fuel rod pitch." In Figures 6.7.2-16 and 6.7.2-17 for the broken rods, it appears that the most reactive configuration for both fuel types is with the moderator density of the cask interior at some value between 30-90%. Provide clarifying information on what the most reactive moderation configuration is.

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SUMMARY:

10. The staff does not understand the explanation of the most reactive fuel pitch starting in the second paragraph of Section 6.7.2.4. Please clarify what is meant by "radial maximum shift of the outer rods." Clarify the legend of Figures 6.7.2-12 and 6.7.2-13.

11. Section 6.7.2.7 states that "the most reactive case is reevaluated by removing the lead and outer shells (including neutron shield), and reflecting the system by water at full density on the X, Y, and Z faces." Provide the dimensions of the reflector.

12. Section 6.7.2.7 states that "Using the maximum reactivity model from Section 6.7.2.5, the calculated keff + 2 σ is 0.85218." The value of 0.85218 is not reproduced in the summary table of maximum reactivity, Table 6.7.2-6. Explain what the analysis assumptions are for this value with respect to moderation and pitch and fuel.

13. It appears that the only difference in the benchmarking between that of Section 6.5.4 and Section 6.5.5 is the version of MCNP, 1.30 vs 1.60. However the difference in USL is significant (0.9171 for version 1.30 and 0.9270 for version 1.60). Discuss the changes to MCNP in going from version 1.30 to 1.60 that causes such a significant change in USL.

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