NRC FORM 699
(03-2013)

U.S. NUCLEAR REGULATORY COMMISSION

CONVERSATION RECORD

DATE OF SIGNATURE	12/18/2015
NAME OF PERSON(S) CONTACTED OR IN CONTACT WITH YOU	See below.
DATE OF CONTACT	12/16/2015
E-MAIL ADDRESS	
TELEPHONE NUMBER	(888) 447-9153
TYPE OF CONVERSATION	☐ E-MAIL ☑ TELEPHONE ☐ INCOMING ☑ OUTGOING
ORGANIZATION	Department of Transportation
DOCKET NUMBER(S)	71-3034
LICENSE NUMBER(S)	
CONTROL NUMBER(S)	

SUBJECT

Additional Information Teleconference

SUMMARY

Nuclear Regulatory Commission (NRC): Chris Allen, Tae Ahn, Meraj Rahimi and Steve Ruffin
Department of Transportation: Michael Conroy
Transnuclear International (TNI): Gregory Gallais and Phillipe Pham

A discussion of the attached questions began at approximately 10:00 A.M. Eastern Standard Time. TNI began by asking if their e-mail response for the bolded Materials question was sufficient. When the NRC admitted it had not had the opportunity to review the response, TNI inquired from what safety analysis report location the NRC had identified a pressure of 0.5 MPa. Although the NRC did not have the location of the information readily available, they committed to providing it as soon as possible after the call. Next, TNI asked why the NRC included radiolysis in its third question when the proposed contents were unirradiated uranium. They also inquired if, by requesting the impact of both thermolysis and the hypothetical accident condition fire on the resin, the NRC wanted to understand how the resin behaved as a function of temperature. After some discussion, the NRC informed TNI that their response need not address radiolysis and that describing how the resin properties changed as a function of temperature was acceptable. Consequently, the NRC committed to revise question three prior to issuing the letter requesting additional information.

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ACTION REQUIRED (IF ANY)

Continue on Page 3

NAME OF PERSON DOCUMENTING CONVERSATION

Chris Allen

SIGNATURE

William L. Allen

CONVERSATION RECORD (continued)

SUMMARY: (Continued from page 1)

After discussions of the materials information requests were completed, TNI indicated it had no questions on any of the remaining information requests. However, the NRC stated it had questions about TNI's criticality analyses. The NRC asked if criticality analyses had been performed for an array of packages without resin present. TNI responded that such analyses had been performed, but that the results restricted the mass of material shipped below the minimum value required by their customer. The call was subsequently concluded at approximately 11:45 A.M. eastern standard time.

Request for Additional Information
Docket No. 71-3034
Competent Authority Certificate No. F/313/B(U)F-96, Rev. Jbb
Model No. TN-BGC1 Package

By application dated July 9, 2015, the Department of Transportation requested revalidation of the Model No. TN-BGC1 package (French Competent Authority Certificate F/313/B(U)F-96, Rev. Jbb). This request for additional information (RAI) identifies information needed by staff in connection with its review of the application.

The RAIs below describe information needed by the Nuclear Regulatory Commission staff to complete its review to determine if the applicant has demonstrated compliance with International Atomic Energy Agency regulatory requirements.

Criticality Review

1. Clarify if changes were made to the packaging for TRIGA fuel and provide corresponding safety analyses if necessary.

   In its application letter, dated July 9, 2015, the applicant requests approval of the TN-BGC1 package for TRIGA fuel (content No. 26 in French Competent Authority Certificate F/313/B(U)F-96, Rev. Jbb). The applicant needs to clarify if a new TRIGA fuel type will be shipped, if different packaging materials or packaging methods were used, etc. If necessary, submit additional criticality safety analysis for either content changes or operational changes associated with TRIGA fuel or demonstrate that the analyses for the approved TRIGA fuel package bound the new contents or packaging methods used.

   The staff needs this information to determine the TN-BGC1 package with requested contents meets the regulatory requirements of para. 673 to 683 of the IAEA TS-R-1, 2009 edition.

2. Provide criticality safety calculations for the uranium oxides (UO_2, UO_3, U_3O_8); uranium tetrafluoride (UF_4); uranium nitrides (UN, U_2N_3, UN_2); uranium carbides (UC, UC_2 and U_2C_3); and uranium alloyed with aluminum (Al), molybdenum (Mo), silicon (Si); and zirconium (Zr) and upper safety limit (USL) values for each type of the requested contents.

   In its application letter, dated July 9, 2015, the applicant requested approval of the TN-BGC 1 package for "the transport and storage of fissile material in very varied forms such as ingots of plutonium or metallic uranium, powders consisting of plutonium oxide or highly enriched uranium, and liquids such as uranyl nitrate." The applicant further clarified that, in addition to metallic uranium in powder form, the requested contents also include uranium oxides (UO_2, UO_3, U_3O_8), uranium tetrafluoride (UF_4), uranium nitrides (UN, U_2N_3, $UN_{2,}$), uranium carbides (UC, UC_2 and U_2C_3) and uranium alloyed with aluminum (Al), molybdenum (Mo), silicon (Si), and zirconium (Zr). However, the criticality safety analyses provided in TN-BGC1-0601, dated June 16th, 2015, only address pure uranium metal. The applicant needs to provide criticality safety analyses for the TN-BGC1 package containing uranium oxide (UO_2, UO_3, U_3O_8) powders, uranium tetrafluoride (UF_4), uranium nitrides (UN, U_2N_3, $UN_{2,}$), uranium carbides (UC, UC_2 and U_2C_3) and uranium alloyed with aluminum (Al), molybdenum (Mo), silicon (Si), and zirconium (Zr).

The staff needs this information to determine the TN-BGC1 package with requested contents meets the regulatory requirements of para. 673 to 683 of the IAEA TS-R-1, 2009 edition.

3. Provide justification that the selected critical benchmark experiments are appropriate for the criticality safety calculations for the requested contents or provide additional benchmark for the powder form uranium oxides (UO_2, UO_3, U_3O_8), uranium tetrafluoride (UF_4), uranium nitrides (UN, U_2N_3, UN_2), uranium carbides (UC, UC_2 and U_2C_3) and uranium alloyed with aluminum (Al), molybdenum (Mo), silicon (Si), and zirconium (Zr) and corresponding USL for each of the contents.

   In TN-BGC1-0600, dated June 11, 2015, the applicant provided code benchmarking analyses for the SCALE 6.0 computer code used for the TN-BGC1 criticality safety analyses. However, it appears that all selected critical experiments are associated with uranium metal, and that none of the selected critical experiments apply to the other content forms. As such, it is not clear how the selected critical experiments are bounding for all requested contents. The applicant needs to either justify that the selected critical experiments are appropriate for the criticality analyses of the requested contents or revise its code benchmark analyses to include critical experiments that are applicable to all requested contents.

   The staff also notes that the USL values provided by the applicant are a function of enrichment, energy of average lethargy causing fission (EALF), hydrogen to fissile material (H/X) ratio, mean free path (MFP), and neutron fission yield for metallic uranium only. However, the applicant did not provide USL values for each content or a bounding USL value for all requested contents. The applicant needs to provide USL values for all of these parameters for each type of requested content or a bounding value for all of the requested contents.

   The staff needs this information to determine the TN-BGC1 package with the requested contents meets the regulatory requirements of para. 673 to 683 of the IAEA TS-R-1, 2009 edition.

4. Provide justification for the credit taken for the remainder of the burned neutron shield in the criticality analyses for the packages under hypothetical accident conditions.

   On page 7 of TN-BGC1-0601, dated June 16, 2015, the applicant states, "For the HAC case, part of the resin is replaced with air (Table presented in Appendix C shows that using air is more conservative than water. ...)". However, the basis for taking credit for both the presence of the burned neutron shield and the material composition of the burned neutron shield under hypothetical accident conditions (HAC)/accident conditions of transport (ACT) is unclear. Specifically, staff is unable to find proof in the safety analysis report that the burned resin will remain uniformly attached to the outer surface of the overpack inner shell as assumed in the model shown in Figure 11-1. The applicant needs to justify the presence of the burned neutron shield as modeled in the HAC/ACT criticality analyses.

   The staff needs this information to determine the TN-BGC1 package with powder form highly enriched uranium and plutonium dioxide meets the regulatory requirements of para. 681 to 683 of the IAEA TS-R-1, 2009 edition.

Materials Review

1. As stated below, provide further rationales (justification, or basis) for eliminating the possibility for a pyrophoric reaction.

   a. The applicant does not present sufficient information on drying conditions of uranium metallic powder both prior to and after inerting.

      In response to staff's 2014 RAI, the applicant indicated the cavity is placed under a 1 mbar vacuum two consecutive times before inerting the cavity at 1 bar. However, the time duration for the 1mbar vacuum is not specified. ASTM C1553 (from PNL-6365) specifies 4 mbar for at least 30 minutes following evacuation. If this condition is not obtained, other industry practices monitor the gas pressure while inerting after vacuum drying. Because clogged, or (chemically or physically) sorbed water is potentially present, the inert gas pressure may need to be monitored a longer time.

   b. The applicant states that, for the amount of uranium shipped, the quantity of air which could enter the cavity is insufficient to sustain a continuous pyrophoric reaction. However, the oxygen needed to sustain a pyrophoric reaction can also be supplied by the presence of water. For example, water vapor may also enter the cavity in addition to air due to HAC/ACT. In addition, water within the cavity due to inadequate drying (see question above) can supply oxygen either through radiolysis or by being present. Therefore, the basis for this assessment may not cover a full range of gas intrusion conditions.

   c. The applicant states that the temperature will not exceed 144 °C. However, if the metallic powder reacts with any oxygen that may be present in the cavity or enters the containment, the temperature may increase due to exothermic reactions of the metallic uranium with oxygen.

   d. The applicant does not discuss how its assessment of pyrophoricity complies with the UN Recommendations on the Transport of Dangerous Goods.

   The staff needs this information to proceed with its review per para. 506, TS-R-1 (2009 Edition).

2. Provide detailed information on the gas pressure increase due to radiolysis and thermolysis under HAC/ACT.

   It is unclear what causes the gas pressure to increase to approximately 0.5 MPa.

   The staff needs this information to proceed with its review per para. 506, TS-R-1 (2009 Edition).

3. Provide information on changes in resin materials properties due to thermolysis, radiolysis or a HAC/ACT fire.

   To evaluate the resin performance after the HAC/ACT fire, the applicant needs to provide information on changes to resin properties such as mechanical strength, density and chemical composition due to thermolysis, radiolysis or a HAC/ACT fire from the as fabricated resin properties.

   The staff needs this information to proceed with its review per para. 506, TS-R-1 (2009 Edition).

4. **Clarify the use of different criteria for package mechanical performance.**

   The applicant discusses an 88 bar pressure criteria for mechanical resistance to (hydrogen) explosion in Chapter 3. However, the applicant presents a 2.11 bar pressure criteria for enclosure tightness in Chapter 9. It is unclear to staff how these criteria were developed and why the values differ so greatly.

   The staff needs this information to proceed with its review per para. 506, TS-R-1 (2009 Edition).

Containment Review

1. Identify the maximum activity (in units of Bq and A_2/g) for content 11 to be transported for this revalidation.

   SAR Chapter 6 (page 15/42, section 7.3.2) states the package release rates will be below regulatory limits provided the contents associated with Case 2, which include content 11, have an activity less than 46 A_2/g under NCT and less than 1448 A_2/g for ACT/HAC. Since Case 2 includes contents other than content 11, it is unclear with which content(s) these activities are associated. The maximum activity (in units of Bq and A_2/g) of content 11 is needed to review the application.

   This information is needed to determine compliance withTS-R-1 paragraph 658, 730, and 807.