Request for Additional Information
for the
Model No. UNC 2600 B(U)F Package
Docket No. 71-5086

By application dated January 29, 2009, Babcock & Wilcox Nuclear Operations Group (NOG) Inc., submitted an application for approval of the Model No. UNC-2600 package for transportation of fuel elements with ^{235}U enrichments up to 100%, with each package being limited to a maximum of 375 grams ^{235}U.

This request for additional information (RAI) identifies information needed by the U.S. Nuclear Regulatory Commission (NRC) staff in connection with its review of the "UNC-2600 Safety Analysis Report for Packaging, Application for License, USA/5086/B(U)F" dated January 2009. The requested information is listed by chapter number and title in the applicant's Safety Analysis Report (SAR).

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

Chapter 1 – General Information

1. Revise the SAR to clearly identify the constituent nuclides, the weight limits of the contents, and the weight limits of the package.

   The application must include a description of the contents in "sufficient detail" to provide an adequate basis for evaluation of the packaging design. The information on the exact composition of the contents is not provided and staff needs to ensure that the contents of the package does not exceed one A_2 quantity because the package does not satisfy the requirement of 10 CFR 71.73. The restriction on the A_2 quantity will ensure that the radioactive materials, if released, will not impose significant radiation risks to the public and the environment.

   On page 1 of the SAR, the applicant provides weight limits for the contents as well as the package. However, it is not clear if these weight limits still are applicable to the new payload restrictions.

   Revise the SAR to reflect these changes if necessary. Otherwise, provide calculation for how the maximum weight of content is determined given the restrictions on the quantity (375 grams) of ^{235}U with consideration of the requested fuel enrichment.

   This information is needed pursuant to the requirements of 10 CFR 71.33 and 10 CFR 71.35.

Chapter 2 – Structural Evaluation

2.1 Revise the SAR to provide the locations of the centers of gravity for this package.

The application indicates that the "center of gravity is essentially the center of the package in both the loaded and empty conditions." This information needs to be more explicit. The weights of the individual parts of the package should also be included.

This information is needed pursuant to the requirements of 10 CFR 71.33.

2.2 Provide clarification on the packaging drawings and codes and standards applicable to the package.

The package is subject to codes and standards such as the American Society for Testing and Materials (ASTM) and the American Welding Society (AWS) standards.

For example, the verification that "all welds are visually acceptable" (for packages procured before 10.9.1992), as stated in Drawing No. B-2600-2, Rev. 3, sheet 4 of 6, should include the AWS procedure for weld inspection, e.g., "as a minimum, all welds are visually examined per AWS 1.6 (1999)." Also, ASTM designations for materials shall be noted.

This information is needed pursuant to the requirements of 10 CFR 71.31(c) and 10 CFR 71.33(a)(5).

2.3 Remove all references to any new fabrication of the package.

The SAR mentions the possibility of new construction of packages. Drawing No. B-2600-2, Rev. 3, sheet 4 of 6, also states that "welds for new construction are per AWS D-1.3." Drawing No. B-2600-2, Rev. 3, sheet 5 of 6, also states the following: "verify weld inspections for new packages." Section 7.1 mentions that "each new container must first be inspected by Quality Control."

The UNC-2600 package is a previously approved package without a "-85" or a "-96" in the identification number of the Certificate of Compliance. As such, fabrication of new packages will not be authorized. A new Condition will be included in the Certificate of Compliance to clarify that the package is subject to the provisions of 10 CFR 71.19(b), which requires that all fabrication of this packaging must have been completed by April 1, 1999.

This information is needed pursuant to the requirements of 10 CFR 71.19(b).

2.4 Demonstrate via calculations or other means that the package is not affected by vibration.

Section 2.6.5 of the SAR does not discuss any peak vibration standard applicable to the package even though the vibration load is not expected to cause structural damage. The SAR states only that "vibration will not effect this welded package construction." A more rigorous (e.g., quantitative) treatment of vibration loads is needed to provide reasonable assurance that the package meets the performance requirements under normal conditions of transport. The applicant should demonstrate that the low mass to stiffness ratio is in fact sufficient to preclude vibration damage to the package.

This information is needed pursuant to the requirements of 10 CFR 71.71(c)(5).

2.5 Demonstrate via calculations or other means that the package is not affected by fatigue due to vibration or other mechanisms.

The SARP does not evaluate fatigue effects on the package, either from vibration due to transport, from opening and closing of the lid or from any other means.

This information is needed pursuant to the requirements of 10 CFR 71.71(c)(5).

Chapter 3 – Thermal Evaluation

3.1 Revise the SAR to identify and describe the principal thermal design aspects of the UNC-2600 package.

Chapter 3 consists of one sentence, i.e., "The uranium materials are unirradiated, of low specific activity and therefore require no thermal evaluation."

While it is true that the decay heat associated with unirradiated fuel is negligible, this Chapter must present the evaluations made to demonstrate the thermal safety of the UNC-2600 package and compliance with the thermal requirements of 10 CFR Part 71 when transporting a payload.

In particular, the package component maximum temperatures and pressures under both normal and accident conditions must be provided and the material properties and component specifications of the package shall be specified in the thermal evaluation chapter. Include also a statement similar to the second paragraph of Section 4.1.

This information is necessary to determine compliance with 10 CFR 71.35.

Chapter 4 – Containment

4.1 Revise the SAR to include the fact that the shallow angle drop orientation could result in lid separation, rupture of the container and ejection of the contents.

Section 4.3.2 refers only to the original licensing basis for the package that was tested but does not mention a potential separation of the lid from a shallow angle drop and the subsequent findings of B&W NOG.

This information is necessary to determine compliance with 10 CFR 71.51, 71. 55, and 71.59.

Chapter 6 – Criticality Evaluation

6.1 Revise the Safety Analysis Report for the UNC-2600 package to remove the irrelevant information presented in the following pages:

1. Table 6.1.1

On pages 14 and 15 of the SAR, the applicant provides criticality safety evaluation results for the UNC-2600 package under both Normal Conditions of Transport and Hypothetical Accident Conditions. However, it appears that the information

presented on page 15 is no longer relevant to the new restrictions on the contents and is inconsistent with the information presented on page 16. The applicant is requested to examine the contents of Table 6.1.1 and make corrections if warranted.

2. Table 6.4.3

On pages 20 and 21 of the SAR, the applicant provides criticality safety evaluation results for the UNC-2600 packages with different payloads. However, it appears that the information presented in pages 20 and 21 is no longer relevant to the new design. The applicant is requested to examine the contents of Table 6.4.3 and make corrections to the SAR if warranted.

This information is needed pursuant to the requirements of 10 CFR 71.33.

Chapter 7 – Operating Procedures

7-1 Provide information on how the extra space will be filled if the allowed payload does not occupy the entire fuel container cavity because of the fissile material quantity limit.

Chapter 7 of the SAR provides operating procedures for the UNC-2600 package. The staff, however, was unable to find detailed information on how the extra space in the fuel container will be filled if the actual payload does not occupy the entire cavity of the container because of the limit on the maximum mass of fissile material (375 grams ^{235}U.) Section 1.2.1 of the SAR mentions "an oak wood block measuring at least $2^{1/2}$" long." Section 7.1 of the SAR states that "elements shorter than 91" <u>may</u> be positioned with longer oak wood spacers." These statements however do not address the question of exactly how the extra space will be filled up with various loads.

For example, if the enrichment of the fuel is 100%, the volume of the 375 grams of ^{235}U is only about 19.84 cm^3, which is about 1.21 cubic inches. In comparison, the cavity of the fuel container of the UNC-2600 package is about 1672 cubic inches. The payload in this case will only take up less than 0.1 % of the space. The applicant is requested to provide information on how the contents are loaded so that they will not move inside the container during transportation.

This information is needed pursuant to the requirements of 10 CFR 71.33.

7.2 Revise the application to address the following items with respect to Package Operations.

(a) Include an operational step that confirms that the fissile mass of the contents does not exceed the allowable fissile mass limit.

(b) Include an operational step to make sure that the maximum payload weight is not exceeded. Section 7.1.3 states that "each box is limited to 265 lbs consisting of elements, wrapping, and spacers" but there is no operational step to ensure this weight limit is not exceeded.

This information is needed pursuant to the requirements of 10 CFR 71.87 and 71.35.

Chapter 8 – Acceptance Tests and Maintenance Program

8.1 Revise Section 8.1 of the SAR to clarify that each fabricated packaging must meet the conditions, dimensions, tolerances, etc., of the drawings in Appendix 2.10.1.

This information is needed pursuant to the requirements of 10 CFR 71.85(c).

8.2 Revise Section 8.2 of the SAR to clarify the periodic maintenance that is performed for this package.

Section 8.2 states that it provides the maintenance program for the package; however, no specific maintenance items are specified. Sections 8.2.3 and 8.2.7 should include a discussion on any moving part and components that would be expected to wear or become damaged.

This information is needed to provide assurance that the package will meet the performance standards in 10 CFR Part 71, Subpart E, throughout its service life.

EDITORIAL

The following editorial comments are noted for information and should be corrected. However, these items do not need to be addressed in an RAI response.

E.1 In Chapter 1.0, GENERAL INFORMATION, specify the date (May 2008) and revision number (No.17) of the applicable "QA Plan approved under Docket No. 71-0088."

E.2 Section 1.2.1 includes an incorrect revision of the Drawing B-2600-2, sheets 1, 2, 3, 4, and 5. Section 1.2.1 refers to "Rev. 1," while Appendix 2.10.1 includes Drawings B-2600-2, sheets 1, 2, 3, 4, 5, and 6, "Rev. 3" and specifies that those represent the current package design.

E.3 Correct the subsections titles and numbers in Section 2.6 of the application, e.g., "2.6.1 Heat and 2.6.2 Cold" on the same line, "2.6.3……and 2.6.4 Pressure," etc.

E.4 Remove all references to any new fabrication in the Licensing Drawings.