January 16, 2014

Mr. Scott P. Murray
Licensing & Liabilities
Global Nuclear Fuel – Americas, LLC
P.O. Box 780
Wilmington, NC 28402

SUBJECT: APPLICATION FOR RAJ–II TRANSPORTATION PACKAGE – FIRST ROUND REQUEST FOR ADDITIONAL INFORMATION

Dear Mr. Murray:

By letter dated October 3, 2013, you submitted an application for amendment of the Model No. RAJ–II transportation package, Certificate of Compliance No. 9309. You requested approval of changes made to reflect the addition of boiling water reactor (BWR) fuel designs.

In connection with the staff's review, we need the information identified in the enclosure to this letter. We request that you provide this information by February 13, 2014. Inform us at your earliest convenience, but no later than February 7, 2014, if you are not able to provide the information by that date. To assist us in re-scheduling your review, you should include a new proposed submittal date and the reasons for the delay.

If you have any questions regarding this matter, please contact me at 301-287-9241.

Sincerely,

/RA/

Huda Akhavannik
Licensing Branch
Division of Spent Fuel Storage and Transportation
Office of Nuclear Material Safety
and Safeguards

Docket No. 71-9309
TAC No. L24800

Enclosure: Request for Additional Information

Mr. Scott P. Murray
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Enclosure: Request for Additional Information
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Request for Additional Information
Global Nuclear Fuel – Americas, LLC
Docket No. 71-9309
Certificate of Compliance No. 9309
Model No. RAJ – II Package

6.0 Criticality

Unless otherwise stated, the following are required in order to ensure that the package will meet the criticality safety requirements of 10 CFR 71.55 and 71.59:

6-1 Revise the application to clarify the maximum amount of polyethylene packing material allowed in the package, and ensure that the maximum amount is considered in the criticality analysis.

Table 6-8 of the safety analysis report (SAR) lists a maximum ethafoam packaging/packing mass per inner container compartment of 11.21 kilograms, for a package total of 22.42 kilograms. This mass of ethafoam, at the stated density of 0.08 g/cm^3, would result in over 280,000 cm^3 of ethafoam. However, Section 6.9.6.3 states that just over 53,000 cm^3 of ethafoam are considered for the polyethylene redistribution evaluation. The analysis should be revised to consider the maximum amount of hydrogenous material that can be present, or the limit in Table 6.8 should be revised to reflect the maximum amount considered in the analysis. Note that the certificate of compliance will include a limit on hydrogenous material that can be present in the package.

6-2 Revise the discussion of Dancoff factor calculation in Section 6.3.3.2 to clarify the results of the comparison of cross-section resonance self-shielding methodologies, and to justify the approach selected for the criticality analysis.

Section 6.3.3.2 of the SAR describes the calculation of Dancoff factors to account for two and three dimensional effects of non-uniform fuel lattice design features. It is not clear if the k_{eff} results reported in the last paragraph of this section are differences between uniform and non-uniform pitch modeling in the SVEA fuel assembly, or between calculations using the MC-DANCOFF calculated Dancoff factors and those using the standard LATTICECELL and MULTIREGION calculated Dancoff factors. In either case, 0.5 and 0.9% differences in k_{eff} are significant, and should be accounted for in the criticality analysis.

6-3 Revise the criticality evaluation for the RAJ-II containing loose rods to clarify if rod containers with less than the maximum number of rods have been considered. Additionally, clarify that the maximum amount of hydrogenous material available for reconfiguration has been considered in the analysis under hypothetical accident conditions.

Tables 6-23, 6-45a, and 6-45b of the SAR demonstrate that less than full loadings of rods have been considered for the hypothetical accident conditions criticality analysis of loose rods without a container. However, it is not clear that less than full loadings of rods have been considered for loose rods in a rod container. Tables 6-24, 6-46a, 6-46b, and 6-46c show the variation of package and array k_{eff} with varying loose rod pitch, but it is not clear if these calculations also considered lower numbers of rods.

Additionally, it is not clear what moderation conditions are assumed for the loose rod evaluation under hypothetical accident conditions. Additional hydrogenous moderating material is available from ethafoam packing that may be included in the loose rod containers, as well as from the loose rod containers themselves (polyurethane cushioning material in the protective case and ethafoam in the WEC rod box). This material may melt during the §71.73 fire condition, and reconfigure to moderate the loose rods in the package, similar to what was considered for the fuel bundle. The criticality analysis should be revised to ensure that this additional moderating material is considered in the loose rod criticality evaluation for hypothetical accident conditions.

6-4 Revise the criticality analysis to include lattice expansion in all hypothetical accident conditions models for fuel bundles and fuel assemblies with and without burnable absorber rods.

Sections 6.3.4.1.2 and 6.9.4 state that the lattice expansion effect for the package array under hypothetical accident conditions is evaluated with burnable absorber rods, implying that it was not also evaluated for fuel assemblies or bundles without burnable absorber rods. Since lattice expansion is a credible result of the §71.73 30 foot (9 meter) drop, it should be included in hypothetical accident conditions models as a representation of the most reactive credible configuration consistent with the damaged condition of the package and the chemical and physical form of the contents. The criticality analysis should be revised to ensure that lattice expansion is considered in the hypothetical accident conditions criticality models for fuel assemblies and fuel bundles, with and without burnable absorber rods.

6-5 Revise the criticality analysis to explicitly include the geometric and material k_{eff} effects from the uncertainty analyses in Sections 6.4.2.2, 6.5.2.2, and 6.6.2.2 in the criticality model.

The k_{eff} effects of material and geometric representations evaluated in the referenced sections of the SAR are not uncertainties, but rather components of the most reactive model that should be used to ensure that the system is adequately subcritical and to determine the subcritical array size. Their effects should not be determined individually and then statistically combined. Specifically, polyethylene modeling and blanket zones without burnable absorber rods should be explicitly included in the normal conditions of transport model. Assembly shift in the inner container, inner container shift in the outer container, container deformation, polyethylene redistribution, internal and external moderation, blanket zones without burnable absorber rods, and pitch expansion should be included in the hypothetical accident conditions model. These geometric and material properties represent either the undamaged package condition as shipped for the normal conditions of transport evaluation, or the most reactive credible configuration consistent with the damaged condition of the package and the chemical and physical form of the contents for the hypothetical accident conditions evaluation.