December 23, 2011

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 – SECOND ROUND REQUESTS FOR ADDITIONAL INFORMATION

Dear Mr. Murray:

By letters dated July 27 and 28, 2011, and September 28, 2011, Global Nuclear Fuels – Americas, LLC (GNF-A) and Westinghouse Electric Company (WEC) submitted responses to a Request for Additional Information (RAI) which had been issued by staff on December 23, 2010, on GNF-A's application for amendment of the Model No. RAJ–II transportation package, Certificate of Compliance No. 9309.

As a result of the staff's review of GNF-A's and WEC's responses to the first round RAI, the staff is issuing the enclosed second round RAI. We request that you provide this information by February 10, 2012. Inform us at your earliest convenience, but no later than February 1, 2012, 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 301-492-3273.

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. L24456

Enclosure: Request for Additional Information

Mr. Scott P. Murray
Licensing & Liabilities
Global Nuclear Fuel – Americas, LLC
P.O. Box 780
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Dear Mr. Murray:

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As a result of the staff's review of GNF-A's and WEC's responses to the first round RAI, the staff is issuing the enclosed second round RAI. We request that you provide this information by March 12, 2012. Inform us at your earliest convenience, but no later than March 1, 2012, 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 301-492-3273.

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Enclosure: Request for Additional Information
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NAME	HAkhavannik	ABarto	MDeBose	MRahimi	MWaters
DATE	12/20/11	12/20/11	12/20/11	12/21/11	12/23/11

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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 §71.55 and §71.59:

6-1 Revise calculation CN-LCPT-10-2, *BA Rod Worth Evaluation of BWR Fuel Designs for Shipment in RAJ-II Package*, to include the computational mesh recommended by ORNL for TSUNAMI analysis in input files for determining gadolinium rod sensitivities.

The TSUNAMI analysis documented in CN-LCPT-10-2 provides direct perturbation calculations used to confirm the validity of the ^{157}Gd sensitivity coefficients in Table 6-10. This table documents a 10.7% difference between the reference direct perturbation calculation and the TSUNAMI result. The results are justified in the paragraph preceding the table with the statement, "Although the comparisons are greater than 15 standard deviations (std dev) apart, the k_{eff} values of the forward and adjoint calculations closely agree for each case, within the code acceptance criteria." Although forward and adjoint k_{eff} agreement is not necessary, the true acceptance criterion is that the computed sensitivity coefficients closely approximate the true response of the model to changes in the nuclide density. In this case, the 10.7% difference is too large and indicates an error in modeling.

Further investigation of the model demonstrates that the computational mesh recommended by ORNL for TSUNAMI analysis was not used in these calculations, resulting in incorrect folding of the forward and adjoint flux. A confirmatory calculation demonstrates that the addition of a SCALE "gridGeometry" block with an initial mesh results in an increase in Gd-157 sensitivity coefficients that vary by 3 - 8% on a pin-by-pin basis for one selected system. It is expected that with refinement of the computational mesh, improved agreement could be achieved with the direct perturbation results, resulting in more accurate sensitivity coefficients for use in determining the most reactive state.

With a non-uniform error introduced in the pin-by-pin sensitivity coefficients, the results of the analysis to determine the most reactive state are suspect. It is recommended that the applicant revise the results using updated TSUNAMI models, including a computational mesh.

Independent confirmation results from SCALE 6.1 for the SVEA infinite assembly model are shown below:

Pin	Original Result	Revised Result	%difference		Pin	Original Result	Revised Result	%difference
22	-2.32E-03	-2.45E-03	5.62E+00		62	-2.58E-03	-2.73E-03	5.58E+00
23	-2.00E-03	-2.10E-03	4.58E+00		63	-2.78E-03	-2.95E-03	5.77E+00
24	-1.97E-03	-2.09E-03	5.65E+00		68	-2.80E-03	-2.96E-03	5.31E+00
25	-2.61E-03	-2.78E-03	6.09E+00		69	-2.55E-03	-2.73E-03	6.72E+00
26	-2.63E-03	-2.81E-03	6.33E+00		72	-1.96E-03	-2.08E-03	5.64E+00
27	-2.03E-03	-2.16E-03	5.90E+00		73	-1.82E-03	-1.97E-03	7.78E+00
28	-1.87E-03	-2.01E-03	7.26E+00		74	-2.83E-03	-2.99E-03	5.38E+00
29	-2.28E-03	-2.42E-03	6.09E+00		77	-2.77E-03	-2.89E-03	4.04E+00
32	-1.97E-03	-2.10E-03	5.84E+00		78	-1.89E-03	-2.00E-03	5.11E+00
33	-1.62E-03	-1.74E-03	7.12E+00		79	-2.02E-03	-2.17E-03	6.89E+00
34	-1.85E-03	-1.97E-03	5.93E+00		82	-1.97E-03	-2.09E-03	5.55E+00
35	-2.80E-03	-3.01E-03	7.11E+00		83	-1.65E-03	-1.76E-03	6.57E+00
36	-2.86E-03	-3.06E-03	6.26E+00		84	-1.83E-03	-2.00E-03	8.34E+00
37	-1.89E-03	-2.05E-03	7.93E+00		85	-2.84E-03	-2.97E-03	4.26E+00
38	-1.64E-03	-1.77E-03	7.15E+00		86	-2.82E-03	-3.00E-03	6.14E+00
39	-1.97E-03	-2.09E-03	6.05E+00		87	-1.87E-03	-1.99E-03	6.13E+00
42	-2.03E-03	-2.18E-03	7.12E+00		88	-1.62E-03	-1.74E-03	6.62E+00
43	-1.87E-03	-2.02E-03	7.75E+00		89	-1.95E-03	-2.08E-03	6.32E+00
44	-2.88E-03	-3.02E-03	4.67E+00		92	-2.36E-03	-2.46E-03	4.34E+00
47	-2.86E-03	-3.05E-03	6.21E+00		93	-2.00E-03	-2.09E-03	4.58E+00
48	-1.83E-03	-1.96E-03	6.79E+00		94	-2.01E-03	-2.18E-03	7.72E+00
49	-2.00E-03	-2.13E-03	5.92E+00		95	-2.60E-03	-2.81E-03	7.47E+00
52	-2.66E-03	-2.79E-03	4.63E+00		96	-2.62E-03	-2.82E-03	7.05E+00
53	-2.84E-03	-3.03E-03	6.28E+00		97	-2.01E-03	-2.14E-03	5.97E+00
58	-2.79E-03	-2.95E-03	5.38E+00		98	-1.95E-03	-2.05E-03	4.80E+00
59	-2.54E-03	-2.68E-03	5.45E+00		99	-2.39E-03	-2.48E-03	3.88E+00

6-2 Revise the responses to RAIs 6-14 and 6-34 of the December 23, 2010, letter to GNF-A, and the associated SAR pages, to clarify the representation of ethafoam packaging material in the package under normal conditions of transport and hypothetical accident conditions, and modify as appropriate.

The response to RAI 6-14 gives a detailed discussion of how the polyethylene cluster separators and wrapping material are accounted for in the criticality analysis, and provides limits on how much of this material can be present for shipping in Table 6-X. However, the 11.21 kg mass of ethafoam, given in Table 6-X, does not appear to be explicitly accounted for in the polyethylene modeling described in the response. Table 6-X will be included in the Certificate of Compliance as an upper limit on polyethylene packing material, and as such, the applicant should ensure that it accurately reflects the maximum amount of material that has been considered in the criticality analysis.

Additionally, although the response to RAI 6-34 addresses potential polyethylene redistribution in the fuel assembly model, it does not appear to have addressed the second part of that RAI, regarding additional polyethylene packing material which may be added to loose rod containers. Any additional polyethylene packing material, or other

high-hydrogen density packing material, which may be present during transportation needs to be accounted for in the criticality analysis, and properly limited in the package operating procedures.

6-3 Revise the criticality analysis to demonstrate that the highest calculated k_{eff} for each system considered remains below the calculated upper subcritical limit (USL) for that system, when considering the revised material and fabrication tolerance uncertainties determined in the response to RAI 6-28 of the December 23, 2010, letter to GNF-A.

The response to RAI 6-28 provides a revised calculation of the k_{eff} uncertainties due to material and fabrication tolerances of the fuel and packaging (Δk_u). These uncertainties have increased due to this revised analysis; however, the maximum calculated k_{eff}s for the package have not been revised to incorporate the revised Δk_u. Revise Tables 6-25, 6-31, 6-44, and any others as appropriate, to include the revised Δk_u, and demonstrate that the resulting maximum k_{eff} for each system remains below the USL.

6-4 Revise Section 6.8 of the SAR to provide the USLs calculated with the revised methodology described in the response to RAI 6-30 of the December 23, 2010, letter to GNF-A. Additionally, demonstrate that the methodology described in this response is appropriate for all of the data sets used to validate the code for the RAJ-II criticality analysis.

The response to RAI 6-30 describes a revised method used to determine the USL using non-parametric margins, as illustrated in NUREG/CR-6698, *Guide for Validation of Nuclear Criticality Safety Calculational Methodology*. However, the response does not provide the recalculated USLs, or show specifically how they were determined. This information should be provided in a revised Section 6.8 of the SAR.

Additionally, Section 2.4.4 of NUREG/CR-6698 states that non-parametric margins are not available for sample sizes less than 10. This would eliminate the use of this methodology for the sample set shown in Figure 6-23 of the SAR, where only 9 data points are shown. The SAR should be revised to either use an alternative method of determining the USL from this data, or to include more benchmark data.

6-5 Revise calculation CN-LCPT-10-2, *BA Rod Worth Evaluation of BWR Fuel Designs for Shipment in RAJ-II Package*, to clarify the selection methodology for lowest-worth gadolinium rods.

The description in this calculation package of how the sensitivities are determined for each allowable gadolinium rod location is clear and the methodology appears reasonable, provided that the information requested in RAI 6-1 of this letter is supplied. However, the methodology for selecting low-worth rods once those sensitivities are obtained is not clear. For example, the calculation states that the assemblies are divided into four square lattices with equal numbers of rods, as shown in Figure 6-8 for a

10x10 assembly. However, it is not clear how this division would be accomplished for a 9x9 assembly, with odd numbers of rows. Additionally, it is not clear that pairing low-worth rods across the major diagonal results in a lower assembly reactivity than considering lower-worth rods that may be directly on the diagonal. For example, Figure 6-9 in the calculation package shows the rod selection results for the SVEA fuel assembly. Rods H8 and C3 have the 3rd and 4th lowest worth in the assembly, respectively, yet are not included in the final selection. It is not clear that selecting these rods as opposed to two of the other rods that were selected would not result in a more reactive assembly. The SAR and calculation package, as appropriate, should be revised to clarify the selection methodology.

Additionally, this evaluation was performed using an undamaged assembly in water. The SAR or calculation package, as appropriate, should be revised to clarify if the results change when considering the presence of polyethylene or an expanded lattice pitch.

Editorial Request

Please provide a revised SAR which incorporates the changes resulting from responses to this round of RAIs and the previous round. A revised SAR incorporating these changes facilitates a smoother review process.