August 31, 2005

Mr. Norman A. Kent, Manager
Transport Licensing and Regulatory Compliance
Westinghouse Electric Company
P.O. Drawer R
Columbia, SC 29250

SUBJECT: CERTIFICATE OF COMPLIANCE NO. 9292 FOR THE MODEL NO. PATRIOT PACKAGE

Dear Mr. Kent:

As requested by your application dated September 16, 2004, as supplemented April 18, 2005, enclosed is Certificate of Compliance (CoC) No. 9292, Revision No. 3, for the Model No. PATRIOT package. This certificate supersedes, in its entirety, Certificate of Compliance No. 9292, Revision No. 2, dated October 10, 2000. Changes made to the enclosed certificate are indicated by vertical lines in the margin. The staff's Safety Evaluation Report is also enclosed.

Those on the attached list have been registered as users of the package under the general license provisions of 10 CFR 71.17 or 49 CFR 173.471. The approval constitutes authority to use the package for shipment of radioactive material and for the package to be shipped in accordance with the provisions of 49 CFR 173.471. Registered Users may request by letter to remove their names from the Registered Users List.

If you have any questions regarding this certificate, please contact me or Mr. Jose R. Cuadrado of my staff at (301) 415-8500.

Sincerely,

/RA/
Robert Lewis, Chief
Licensing Section
Spent Fuel Project Office
Office of Nuclear Material Safety
and Safeguards

Docket No. 71-9292
TAC Nos. L23769, L23770

Enclosures:
1. Certificate of Compliance No. 9292, Rev. No. 3
2. Safety Evaluation Report
3. Registered Users List

cc w/encl 1 & 2:
R. Boyle, Department of Transportation
J. Shuler, Department of Energy
RAMCERTS
Registered Users

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Distribution: (closes TAC No. L23769, L23770)

NMSS r/f SBaggett SWilliams MRahimi NOsgood JCaverly
Jumana RBellamy, RI DCollins, RII CMiller, RIII BSpitzberg, RIV

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OFC	SFPO	E	SFPO	E	SFPO	E	SFPO	E	SFPO	
NAME	JCuadrado		MDeBose		MCall		LCampbell		RLewis	
DATE	8/16/05		8/18/05		8/19/05		8/20/05		8/31/05	

C = COVER **E = COVER & ENCLOSURE** **N = NO COPY**

SAFETY EVALUATION REPORT

Docket No. 71-9292
Model No. PATRIOT Package
Certificate of Compliance No. 9292
Revision No. 3

SUMMARY

By application dated September 16, 2004, as supplemented April 14, June 14, and August 9, 2005, Westinghouse Electric Company, LLC submitted a renewal and amendment request for Certificate of Compliance (CoC) No. 9292 for the Model No. PATRIOT package. Specifically, Westinghouse requested to renew the CoC and to modify the authorized contents in the CoC. This revision includes adding a new type of unirradiated (fresh) fuel assembly to the authorized contents of the package.

The renewal and amendment request included a new consolidated application, in addition to the necessary engineering analyses and proposed CoC and application page changes necessary to support the amendment request. The new consolidated application will be referenced in the CoC.

The U.S. Nuclear Regulatory Commission (NRC) staff has reviewed the renewal and amendment request, including the proposed CoC and application revisions, and other supporting documents submitted with the request. Based on the statements and representations in the application, as supplemented, the staff concludes that the Model No. PATRIOT package, as amended, meets the requirements of 10 CFR Part 71. The certificate has been renewed for a period of five years

1.0 GENERAL INFORMATION

The applicant requested to revise Condition 5 of the CoC, “Contents,” to include a new fuel type as authorized contents. The new fuel type is included in the CoC as condition 5(b)(ii). These changes are discussed in detail below, in the “Conditions” Section of this Safety Evaluation Report (SER). The changes requested by the applicant only affect the criticality safety evaluations of the application. Therefore, only this section will be discussed in this SER.

In addition to the amendment request, the applicant requested renewal of the CoC. In support of the renewal request, the applicant provided a consolidated application, as specified in 10 CFR 71.38(c). The staff reviewed the new consolidated application submitted by the applicant, and determined that the application incorporated those changes to the package application previously approved and referenced in the CoC. The staff also reviewed the operating and maintenance procedures for the package and found them to be adequate.

In addition to the changes requested by the applicant, the staff has made additional revisions to the CoC in order to reflect changes to the regulations in 10 CFR Part 71, which became effective in October 1, 2004 (69 FR 3698). These changes do not affect the design of the package or the safety basis for this approval.

6.0 CRITICALITY

The proposed amendment adds a new fresh fuel 10x10 Boiling Water Reactor (BWR) assembly type to the approved contents of the PATRIOT shipping container. The proposed assembly type is defined by the characteristics of its three axial zones, which are described in Section 6A.2.1 of the application as loading types 4 - 6. Each zone is defined according to maximum enrichment, number and placement of fuel rods and water holes (water holes appearing where partial fuel rods don't extend into the axial zone), minimum number of Gadolinia rods, and minimum Gadolinia content of the Gadolinia rods. Unlike the approved contents of Revision No. 2 of the CoC, the proposed contents will be shipped in channels. Therefore, plastic inserts will not be used with the proposed contents and were not included in the criticality analyses. The purpose of the current review is to verify that the criticality requirements of Part 71 of Title 10 of the Code of Federal Regulations (10 CFR Part 71) are met for a PATRIOT package loaded with the proposed contents. This review follows the guidance provided in NUREG-1609, "Standard Review Plan for Transportation Packages for Radioactive Material."

6.1 Applicant's Model and Analysis

The applicant performed its analysis with SCALE 4.4, using the CSAS25 and CSASN criticality sequences and the 238-group ENDF/B-V cross-section library. The code is a more current version of SCALE than was used in previous applications. The cross-section library is also more current and has a different group structure than the previously used library. Therefore, the applicant performed a new benchmark analysis from which the computational bias and the Upper Subcritical Limit (USL) were determined to be 0.0157 and 0.9343, respectively.

Since there were no changes to the packaging design, the applicant analyzed the proposed contents in the model identified in previous analyses, and found by staff, to be the most reactive. This model is an array of 104 (8x13x1) damaged packages. The applicant made some modifications to the model for use in the current analysis. The modifications include removal of the plastic inserts in the assemblies, inclusion of assembly channels, partial flooding, and movement of assemblies to different locations in the basket cells.

The applicant analyzed the damaged package array for three different package flooding configurations: 1) fully flooded, 2) partially flooded with the packages all oriented the same, and 3) partially flooded with the package orientation alternating by row in the array. In the partially flooded package, the water level outside of the basket was higher than in the basket. The applicant varied the water moderator density from 8% to 100% of full density for each configuration. The applicant also examined the effect of assembly position within the basket cells for the different flooding configurations and moderator densities.

The applicant applied various assumptions to the models for the proposed contents. First, the applicant assumed the fuel to be full density UO_2 (10.96 g/cc). No credit was taken for pellet dishing, chamfering, etc. Nominal pellet and cladding diameters were used. Only the active fuel length of the rods is modeled (381 cm); any part of the packaging extending beyond the active fuel length was neglected too. The analysis only took credit for 75% of the minimum specified Gadolinium poison content. Finally, all rods in a fuel bundle configuration were assumed to be full length; thus, each axial zone of the proposed contents was modeled as a full-length assembly.

The applicant determined that the most reactive model was an array of damaged packages partially flooded with 30% dense water, with all the packages oriented in the same direction and loaded with fuel loading 6 assemblies at the maximum horizontal separation. This model produced a k-effective of 0.9299 (including 2σ), which is lower than the USL. The applicant also analyzed the most reactive model for the condition where the flooding level was uniform inside the package. This analysis indicated that k-effective increased by ~0.2% but still remained below the USL.

6.2 Staff Review

The staff reviewed the description of the proposed contents and concluded that it provides an adequate basis for the criticality evaluation. The staff also reviewed the sample SCALE 4.4 input file against the contents specification, text description of the model, and engineering drawings and found these items to be consistent.

The staff reviewed the applicant's benchmark analysis and bias determination. This review included evaluation of the benchmarks' applicability. In its review, staff noticed that several of the experiments contained borated water or other borated materials, none of which appear in the Patriot packaging design. Therefore staff questions the applicability of these experiments. However, based upon the information presented by the applicant, the staff noted that the analyses of many of these experiments resulted in relatively lower k-effectives; therefore, their inclusion would tend to result in a more conservative bias and USL.

Staff also reviewed the applicant's discussion of potential trends in the bias. The applicant evaluated the bias as a function of the energy of the average lethargy causing fission (EALF) and fuel enrichment and determined that the bias did not exhibit any trends. However, the EALF range of the package analysis exceeds the range covered by the benchmarks. Staff therefore also referred to NUREG/CR-6686 in its review to determine whether trends may exist beyond the range covered by the benchmarks. Based on its review, staff has reasonable assurance that, while the EALF range of the package analysis isn't completely covered by the benchmarks, there is no significant trend in the bias. Staff review of a correlation of bias with enrichment indicated there is a trend in the bias with respect to enrichment; however, in determining the USL, the applicant used the largest bias resulting from this correlation to enrichment, which was the largest bias calculated in the trending analysis.

Based upon this review, the staff finds that the benchmarks provide adequate coverage of the range of parameters for the proposed contents and that the bias calculated by the applicant is an appropriate bias for the criticality analysis in the application.

During the review, staff also performed independent confirmatory calculations. These calculations were performed using the SCALE 5.0 version of the SCALE code system developed by Oak Ridge National Laboratory. The calculations were done using the 238-group ENDF/B-V cross-section library and the CSAS25 criticality sequence. Staff confirmed that the most reactive model is an array of partially flooded damaged packages all oriented in the same direction and loaded with fuel loading 6 assemblies. However, staff calculations indicated that the optimum moderator is 25% dense water. Yet even at this moderator density, system reactivity remained less than the USL.

Staff also performed calculations for the most reactive model with uniform partial flooding. While the applicant determined the difference between this partial flood condition and the original partial flood condition to be insignificant, both the staff's and the applicant's calculations show that modeling the partial flood level as uniform in the package raised k-effective by ~0.2%. With 30% dense water moderator, k-effective (including 2σ) was still less than the USL. However, for 25% dense water moderator, staff calculations resulted in a k-effective that is slightly higher than the USL. The difference between the k-effective and the USL is ~1σ, a difference that is within statistical error. Staff noted that the mass of steel in the modeled angle irons was conservative (i.e., less than the mass of the angle irons shown in the engineering drawings). The mass of steel modeled in the angle irons has a significant impact on system reactivity. Increasing the modeled mass of steel to more closely equal the mass in the actual angle irons decreases system reactivity such that k-effective (including 2σ) is less than the USL. Therefore, staff finds there is reasonable assurance that the system will remain subcritical.

Staff also reviewed the applicant's determination of the Criticality Safety Index (CSI) and found that the applicant correctly calculated the CSI to be 1.0.

6.3 Findings

Based on the review of the information and representations made by the applicant in the amendment application and independent analyses, the staff finds there is reasonable assurance that the package design with the proposed contents meets the criticality requirements of 10 CFR Part 71.

CONDITIONS

The following conditions in CoC No. 9292, Revision No. 3, have been revised as follows:

Condition 5(a)(3) was revised to change the drawing references. The drawing changes were administrative in nature and did not involve any changes to the package design.

Condition 5(b)(1) has been revised to modify its numbering and include the new fuel assembly type. The new fuel assembly type is described in condition 5.(b)(1)(ii).

Condition 5(c) of the CoC was revised to replace the wording "Transport Index for Criticality Control" with "Criticality Safety Index" as defined in 10 CFR 71.4.

Condition 7 of the certificate has been revised to specify that the use of polyethylene inserts for transport of fuel assemblies is limited to the contents described in condition 5.(b)(1)(i). No polyethylene inserts may be used with the fuel assembly type described in 5.(b)(1)(ii).

Condition 9 of the certificate was revised to clarify that the package is approved for use under the general license provisions of 10 CFR 71.17. This change is due to a revision in the numbering of the sections of 10 CFR Part 71, which became effective on October 1, 2004 (69 FR 3698).

CONCLUSIONS

Based upon the staff's review, the statements and representations in the application, as supplemented, for the reasons stated in this Safety Evaluation Report, and with the conditions listed above, we conclude that these changes will not affect the ability of the package to meet the requirements of 10 CFR Part 71.

Issued with Certificate of Compliance No. 9292, Revision No. 3,
on August 31, 2005.