July 6, 2011

Mr. Wes Stilwell
Manager
Licensing, Compliance and Package Technology
Westinghouse Electric Company, LLC
5801 Bluff Road
Columbia, SC 29209

SUBJECT: CERTIFICATE OF COMPLIANCE NO. 9297, REVISION NO. 5, FOR MODEL NO. TRAVELLER STD AND TRAVELLER XL PACKAGES

Dear Mr. Stilwell:

As requested by your application dated November 19, 2010, supplemented April 20 and June 17, 2011, enclosed is Certificate of Compliance No. 9297, Revision No. 5, for the Model No. Traveller STD and Traveller XL packages. 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 Pierre Saverot of my staff at (301) 492-3408.

Sincerely,

/RA/

Michael D. Waters, Chief
Licensing Branch
Division of Spent Fuel Storage and Transportation
Office of Nuclear Material Safety
and Safeguards

Docket No. 71-9297
TAC No. L24488

Enclosures:
1. Certificate of Compliance No. 9297, Rev. No. 5
2. Safety Evaluation Report
3. Registered Users List

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

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<u>DISTRIBUTION</u>: (Closes TAC L24488)
SFST f/f NMSS r/f

G:/SFST/PART 71CASEWORK/71-9297.r5.doc and 71-9297 r5.LTR&SER.docx **ADAMS Package No.: ML111890028**

OFC:	SFST	E	SFST		SFST		SFST		SFST		SFST	
NAME:	PSaverot		CHrabal		JSolis		DTarantino		NDay		MRahimi	
DATE:	06/14/11		06/14/11		06/23/11		06/21/11		06/23/11		06/29/11	
OFC:	SFST	E	SFST		SFST		SFST		SFST		SFST	
NAME:	KWitt		DPstrak		MDeBose		M. Sampson for MWaters					
DATE:	06/22/11		06/27/22		06/30/11		7/6/22 ~~6/30/11~~					

C= Cover E = Cover & Enclosure N = No Copy

SAFETY EVALUATION REPORT

Docket No. 71-9297
Model Nos. Traveller STD and Traveller XL
Certificate of Compliance No. 9297
Revision No. 5

SUMMARY

By application dated November 19, 2010, as supplemented, Westinghouse Electric Company, LLC (Westinghouse or the applicant) requested an amendment to Certificate of Compliance (CoC) No. 9297 for the Model Nos.Traveller STD and Traveller XL packages.

NRC staff reviewed the application using the guidance in NUREG-1609, “Standard Review Plan for Transportation Packages for Radioactive Materials.” Based on the statements and representation in the application, and the conditions listed below, the staff agrees that the requested changes do not affect the ability of the package to meet the requirements of 10 CFR Part 71.

EVALUATION

By application dated November 19, 2010, as supplemented April 20 and June 17, 2011, Westinghouse requested an amendment to CoC No. 9297, to modify the designs of the clamshell top end plate, the axial spacer, and the outerpack. Operational experience with the Model Nos. Traveller STD and XL packages showed that some fuel types could not be either loaded or unloaded vertically with existing customer handling tools. In particular, the 17X17 XL fuel with guide pins could not be vertically loaded/unloaded into the package due to an interference between the handling tool and the clamshell shear lip. The previous tool could not be installed or removed without tilting the fuel handling tool, thus potentially damaging the fuel assembly. Additional evaluations showed similar interference issues with Core Component Assemblies.

The top plate of the clamshell has two configurations in order to accommodate different fuel types, as described in Section No. 1.2.1.3 of the application. The Removable Top Plate has a new configuration to eliminate the interference of the clamshell shear lip with the fuel handling tool. The new (or modified) outerpack’s components include silicone rubber weather gaskets, tie down chain tray gussets, swing bolts, and clamshell cam lock wave washers. The new weather gasket material was added to enhance performance as evaluated in the application.

The nominal dimensions of the guide tube wall thickness, guide tube outer diameter and of the pellet diameter of a 16x16 Type ATOM fuel assembly were also revised.

In support of the request, the applicant provided a consolidated application as specified in 10 CFR 71.38(c). Revision No. 9 of the application dated June 17, 2011, supersedes all previous revisions of the application. The staff reviewed the consolidated application and determined that the changes did not affect the ability of the package to meet the requirements of 10 CFR Part 71.

1.0 GENERAL INFORMATION

1.1 Package Description

The Model Nos. Traveller STD and XL packages, designed to transport either one non-irradiated uranium fuel assembly or multiple loose rods with a maximum enrichment of 5.0 weight percent, consists of three main components: an outerpack, a clamshell, and either the fuel assembly or a rod box.

The outerpack serves as the primary impact and thermal protection for the contents and also provides for lifting, stacking, and tie down during transportation. Independent impact limiters, consisting of two sections of foam of different densities sandwiched between three layers of sheet metal, ~~are~~ integral parts of the outerpack. Polyethylene foam sheeting may be positioned between the clamshell and the lower outerpack to augment shock absorbing characteristics of the package during routine transportation. A weather gasket positioned between the mating surfaces of the upper and lower outerpack, prevents the rain from entering the package, ~~and reduce~~s ~~damage to the contents during~~ either ~~an end or high-angle~~ ~~drop~~.

The clamshell ~~is a structural component~~ designed to protect the contents during routine handling and limit their rearrangement in the event of an accident. The clamshell consists of an aluminum “v” extrusion, two aluminum door extrusions, and a small access door. Each extruded aluminum door is connected to the “v” extrusion with piano-type hinges (continuous hinges) and held closed with a latching mechanism and quarter-turn bolts. Neutron absorber plates are installed in each leg of the “v” extrusion and in each of the doors. The “v” extrusion and the bottom plate are lined with a cork rubber pad to cushion and protect the contents during normal handling and transport conditions. The clamshell is fastened to the lower outerpack using shock absorbing rubber mounts.

1.2 Contents

The Model Nos. Traveller STD and XL packages are designed to transport a single fresh PWR fuel assembly of a variety of designs and sizes, as listed in Section No. 6.10.2 of the application. The fuel assemblies have different rod arrays, lengths, and fuel rods, but all consist of uranium dioxide pellets inside zirconium alloy tubes that are held together by stainless steel or Inconel grid spacers, guide tubes, and upper and lower nozzles. Any number of fuel pins in an assembly may be replaced by a stainless steel rod as long as weight limits are not exceeded, because a stainless steel rod has equal or better mechanical, thermal, and corrosion properties when compared to a fuel pin, and because a stainless steel rod does not contain any fissile material. In addition, secondary source rods or rod cluster control assemblies may be inserted into the guide tubes of an assembly.

The maximum number of fuel rods that may be transported is limited by the dimensions of the fuel rod, e.g., fuel rod diameter, and packaging materials used to protect the fuel rods. Fuel rods include designs for both PWR and BWR. For the range of fuel rod diameters (0.37-0.45 inch), the maximum theoretical number of fuel rods would be 251 to 169 but the actual number will be less because of the space required to accommodate packaging materials and for handling fuel rods.

Individual rods and fuel assemblies may be wrapped in a polyethylene sleeve. The rod pipe or the fuel assembly is placed in the clamshell and secured using an axial restraint and aluminum spacers.

The maximum contents weight is 748 kg (1,650 lbs) for the Model No. Traveller STD package and 894 kg (1,971 lbs) for the Model No. Traveller XL package.

1.3 Drawings

The packaging is constructed and assembled in accordance with Drawing No. 10004E58, Rev. 6, sheets 1-9.

1.4 Evaluation Findings

A general description of the package is presented in Section No. 1.0 of the package application, with special attention to design and operating characteristics and principal safety considerations. Drawings for structures, systems, and components important to safety are included in Section No. 1.3 of the application.

The package application identifies the Westinghouse Quality Assurance Program for the package and the applicable codes and standards for the design, fabrication, assembly, testing, operation, and maintenance of the package.

The staff concludes that the information presented in this section of the application provides an adequate basis for the evaluation of the package against 10 CFR Part 71 requirements for each technical discipline

2.0 STRUCTURAL EVALUATION

The objective of the structural review is to verify that the structural performance of the package has been adequately evaluated and meets the requirements of 10 CFR Part 71, including performance under normal conditions of transport (NCT) and hypothetical accident conditions (HAC).

2.1. Evaluation of Structural Design Changes

The amendment request included a new structural evaluation for the clamshell top plate and axial spacer.

2.1.1 Clamshell Top End Plate Evaluation

Westinghouse proprietary report SFAD-09-184, Rev. 1, details the analysis of the new design for the clamshell top end plate. A 17X17 XL fuel assembly was selected because it is the longest and heaviest fuel assembly that can be shipped in the package. The bounding drop orientation is the 9-m top end HAC case.

A new LS-DYNA model, created to optimize the new design of the top end plate, was benchmarked by modeling the “old” design and comparing the deformations, maximum impact forces, and clamshell peak forces to those of the “old” finite element model and prototype test. The new model is deemed to be properly benchmarked since it adequately replicates the original design results. The Finite Element Analysis (FEA) showed that the pillow and clamshell bolts can accommodate the fuel loading configuration with, or without, any fuel assembly guide pins. The results also suggest that the pillow would provide adequate impact load protection even if there were no axial clamp studs.

The staff reviewed the FEA analysis and determined that the new clamshell top end plate design is acceptable with no adverse effects on the structural performance of the package.

2.1.2 Clamshell Axial Spacer Structural Evaluation

By adding a 28.94-inch long aluminum spacer to the clamshell cavity, the Model No. Traveller XL package is capable of transporting the 17X17 STD type fuel. Westinghouse proprietary report SFAD-10-72, Rev. 2, details the evaluation of the axial spacer. Both the ENUSA or Westinghouse spacers are used in the Model No. Traveller XL package; their designs are similar, but vary in length for different fuel designs.

The evaluation was performed using the LS-DYNA model that was used in the original application. The assumptions and boundary conditions that were used for the model are detailed in Section No. 2.12.6.3 of the application. The bounding drop orientation is the 9 m bottom end HAC free drop case which was increased to a height of 10 m for conservatism. Results for the ENUSA spacer are presented in the application as typical of the axial spacer and considered to be the most severe with respect to the acceptance criteria. During the end drop impact, the pillow crushes 2.4 inches, the end limiter crushes 0.27 inches, and the aluminum pipe section crushes 4.45 inches. The spacer assembly is both stable within the clamshell and capable of local plastic straining. The average deceleration for the end drop was 147g which is lower than that for the configuration without an axial spacer, and will experience less stress in the clamshell.

The staff reviewed the end drop results and determined that the axial spacer is acceptable and has no adverse effects on the structural performance of the package.

2.1.3 Evaluation Findings

A number of components that were modified or added for this amendment request, including the silicone rubber weather gasket, the tie-down chain tray gussets, the swing bolts, and the clamshell cam lock wave washer, do not change the original functions of the package’s structural capability and need not be reviewed. Staff reviewed the changes related to the clamshell axial spacer and removable top plate and determined that those modifications are acceptable and have no adverse effects on the structural performance of the package for meeting the requirements of 10 CFR Part 71.

2.2 Evaluation of Changes Related to Material Properties

Staff reviewed the changes, corrections, and clarifications related to the material properties of the package.

2.2.1 Outerpack

The outerpack shell, made of ASTM A240 or A276 Type 304 stainless steel, is filled with three different grades of closed-cell polyurethane foam corresponding to three different foam densities of 6 pcf (pounds per cubic foot), 10 pcf, and 20 pcf. The axial cylindrical portion of the outerpack is filled with 10 pcf foam, the ends of the outerpack are filled with 20 pcf foam, and the pillow sub-assemblies that are part of the impact limiter system are filled with 6 pcf foam. The mechanical and thermal properties of the 304 stainless steel have been checked against the ASME B&PV Code Section II, Part D, and found to be correct. The foam crush strength was provided as a function of temperature and strain for all three foam densities and found to be in agreement with publicly available data for similar closed-cell polyurethane foams. The foam thermal properties were also checked and found to be in agreement with publicly available data for similar closed-cell polyurethane foams.

A weather gasket is used between the upper and lower portions of the outerpack to prevent rain and water spray from entering the package. The weather gasket is made of either fiberglass or silicone rubber. These seals have no structural or thermal function, thus only their melting temperature is provided in Table No. 3-2 of the application. The melting temperatures of the weather gasket materials have been checked against publicly available data and found to be correct.

2.2.2 UHMW Polyethylene Moderator Blocks

Neutron moderation is ensured by the Ultra High Molecular Weight (UHMW) polyethylene (PE) attached to the upper and lower sections of the outerpack. The density, melt temperature, and thermal properties of the UHMW PE blocks provided in Table No. 3-2 of the application have been checked against publicly available data and found to be correct.

In order to help protect the UHMW PE moderator blocks from thermal damage during a fire accident, refractory fiber felt insulation may be used to wrap certain portions of the moderator blocks. The density, melt temperature, conductivity, and specific heat of the insulation provided in Table No. 3-2 have been checked against publicly available data and found to be correct.

2.2.3 Clamshell

The clamshell components and the removable top plate (RTP) or fixed top plate (FTP) are made of ASTM B221 or ASTM B209 aluminum alloy 6005-T5 or 6061-T6. These alloys are very similar in chemical composition, and have very similar mechanical and thermal properties. Cork rubber pads cover the inside of the clamshell to protect the contents in NCT, but have no structural function. An additional layer of cork rubber held by ⅛” thick aluminum sheet metal, i.e., the Fuel Spacer Assembly, covers two sides of the clamshell of the Model No. Traveller XL package with the RTP.

The mechanical and thermal properties of ASTM B221 or ASTM B209 aluminum alloy 6005-T5 or 6061-T6 have been checked against the ASME B&PV Code Section II, Part D, "Nonferrous Material Specifications, SB-221," and found to be correct.

2.2.4 BORAL Plates

Borated 1100 series aluminum (BORAL, proprietary material) plates cover the inside wall of the clamshell over the entire fuel length and serve as a thermal neutron absorber for criticality control. The staff finds that BORAL is acceptable for use in the package. In addition, the melting point of 1100 series aluminum used for the BORAL is high enough to preclude melting from occurring during HAC conditions.

2.2.5 Axial Spacer

The mechanical and thermal properties of the axial spacer's aluminum alloy 6063-T6, 6082-T6, and 6061-T6 have been checked against the ASME B&PV Code, Section II, Part D, and found to be correct. Aluminum alloy 6082-T6 exhibits a higher yield strength when compared to 6061-T-6 and 6063-T6 and is a preferred material. The mechanical properties of the Neoprene 60 rubber pad, placed between the axial spacer and the clamshell for additional shock absorption, were checked against publicly available data and the shear modulus was found to be higher than published data by a factor of 2 to 5. However, Westinghouse proprietary report SFAD-10-72 Rev. 2 shows that, even if the shear modulus is reduced by a factor of 10, the axial spacer behavior is not significantly affected; thus, the choice of a high shear modulus has no impact on safety. The staff finds this conclusion to be acceptable.

2.3 Chemical, Galvanic, and Other Reactions

No chemical interactions are expected between the metallic and the non metallic materials in the package. The outerpack and clamshell are made of dissimilar metals but the clamshell is held away from the outerpack with rubber pads; thus, they are never in contact and no galvanic reactions are expected under normal operations. The fasteners in the clamshell are in contact with aluminum, and the galvanic potential difference between these two dissimilar metals is too high to completely preclude any galvanic interaction, but the surface of the aluminum is much greater than that of the fasteners. As a result, the cathode-to-anode ratio is very small, and significant degradation of the aluminum will be precluded. Finally, neither the outerpack 304 stainless steel nor the clamshell aluminum (physically isolated inside the outerpack) has any significant chemical or galvanic reaction with air or water.

Radiation levels under normal handling and transport conditions are negligible for the package, thus no materials will be adversely affected by radiation.

3.0 THERMAL EVALUATION

3.1 Review Objectives

The objective of the thermal review for the Model No. Traveller package is to verify that the thermal performance of the package has been adequately evaluated for the tests specified under NCT and HAC, and that the package design satisfies the thermal requirements of 10 CFR Part 71. This case was also reviewed to determine whether the package fulfills the acceptance criteria listed in Section 3 of NUREG-1609, "Standard Review Plan for Transportation Packages for Radioactive Material," as well as associated Interim Staff Guidance (ISG) documents.

3.2 Description of the Thermal Design

3.2.1 Package Design Features

The package consists of an aluminum clamshell mounted within a cylindrical outerpack fabricated from 304 stainless steel and flame retardant polyurethane foam. The stainless steel/foam sandwich provides thermal insulation during HAC fire conditions.

3.2.2 Content Heat Load Specification

The unirradiated fuel assembly does not generate any heat inside the package.

3.2.3 Summary Tables of Temperatures

The results from the thermal evaluation of the package are summarized in Table No. 3-1 of the application for both NCT and HAC. The results show that all temperatures are below design limits.

3.2.4 Summary Tables of Maximum Pressures in the Containment System

The package is not designed to maintain a pressure differential and therefore is in approximate equilibrium with external air pressure.

The staff reviewed the package's thermal features, heat load, and summary of maximum temperatures and pressures to determine compliance with the Standard Review Plan's acceptance criteria and found them acceptable.

3.3 Material Properties and Component Specifications

Material properties (density, specific heat, and thermal conductivity) for aluminum, stainless steel, polyethylene, and polyurethane foam are provided in Table No. 3-2 of the application. These properties are used to determine the thermal response during HAC.

The staff reviewed the material thermal properties provided in the application and determined that adequate values were provided for the specific materials.

3.4 General Considerations for Thermal Evaluations

The applicant performed the thermal evaluation by analysis and actual test: the thermal analysis examined the principal heat transport path (radial direction) while the seam burn tests examined radial heat flow with prototypical gas infiltration through the outerpack seams. The impact limiter burn tests examined and measured the heat transport through the ends of the package. The applicant combined all possible heat transport mechanisms in a final qualification test to demonstrate the suitability of the design.

The tests (described in the application) identified features (continuous hinge lengths and a large lip over the bottom seam) that prevent hot gases from entering the outerpack seams. The applicant used the results of those tests to show that internal temperatures remain low when the outerpack seams are adequately protected. These features were incorporated into the certification test unit (CTU) article and the production design. When the CTU was tested, significant margins of safety were observed as illustrated by Table No. 3-1 of the application.

The staff reviewed the applicant’s approach to perform the thermal evaluation to determine compliance with the Standard Review Plan and found it acceptable.

3.5 Thermal Evaluation Under NCT

The applicant stated that since the package is only used to ship non-irradiated fuel or fuel rods, package temperatures will not significantly exceed ambient temperatures. The package is not hermetically sealed allowing interior pressure to adjust with changes in elevation and allowing expansion/contraction of internal air during temperature changes. Therefore, a thermal evaluation is not necessary for NCT.

The staff reviewed the applicant’s justification for not performing a thermal evaluation during NCT and found it acceptable.

3.6 Thermal Evaluation Under HAC

3.6.1 Thermal Analysis

The applicant developed a simplified computer model using the HEATING7.2 code distributed by Oak Ridge National Laboratory as a part of SCALE 4.4. The model was built in cylindrical coordinates. The thermal analysis performed by the applicant demonstrated several important features/characteristics of the design. Because of the urethane foam insulating the outerpack, exterior skin temperatures quickly rise to near equilibrium with the fire outside the package. The clamshell and fuel assembly temperature, rise very slowly due to the insulation and the specific heat of the aluminum clamshell, polyethylene moderator, and the fuel assembly.

The primary mechanisms that can result in significantly higher internal temperatures are hot gas infiltration during the fire and internal combustion during and after the fire test. The applicant does not believe that these mechanisms can be accurately predicted by analysis. As a result, the applicant chose to demonstrate the package using a full-scale fire test.

3.6.2 Fire Test

The applicant used a burn test of a full-scale package loaded with a simulated fuel assembly to demonstrate the package's thermal performance in a hypothetical fire accident. The unit that was utilized was identified as the certification test unit (CTU) and subjected to a regulatory drop test.

The package was installed in a burn pool and subjected to a 32 minute burn test. Although the outerpack had suffered minor damage that allowed some urethane decomposition products to escape into the package interior, the fuel assembly, clamshell, and polyethylene moderator were essentially undamaged.

Before and during the pool fire, temperature measurements were made at 16 locations using type K thermocouples. During the test temperatures were measured at six locations on the package skin, at twelve locations inside the pool fire, at four locations using directional flame thermometers (DFTs) facing away from the package, and from outside the fire using two optical thermometers.

3.6.3 Initial Conditions

The package was covered with a canvas tent. Two 44 kWth kerosene heaters were used to maintain air temperature inside the tent to above 37°C. The heaters were secured and the tent removed approximately 75 minutes before the beginning of the fire test. Air temperature around the package at this time was about 50°C. The air temperature and outside surface temperature dropped to approximately 5°C.

3.6.4 Fire Test Conditions

Fire temperatures were measured using four directional flame thermometers (DFTs) and 12 thermocouples suspended in the fire 0.9 m from the surface of the package. The 30 minute average temperatures measured by the DFTs were 833°C. The 39 minute average temperature measured by the thermocouples suspended in the fire was 859°C. Two hand-held optical thermometers that measured flame temperature from outside the pool supplemented these measurements. The average readings made with these thermometers was 958°C.

3.6.5 Maximum Temperatures and Pressures

The 30 minute average temperature measured at the outerpack outer skin was 904°C. Temperatures inside the CTU outerpack were measured using 13 sets of non-reversible temperature strips. One set on the inner stainless steel skin covering the outerpack lid moderator was unreadable. All of the remaining temperature strips on the outerpack lid recorded temperatures of 177°C or below. Temperatures on the inside surface of the top and bottom impact limiters were 116°C and 149°C respectively. Temperatures inside the clamshell were below 104°C.

The Model No. Traveller design is a non-pressurized package and cannot retain internal pressure. Gaskets are discontinuous to prevent internal pressurization during the hypothetical fire and during normal variations of temperature and atmospheric pressure. The polyurethane foam space between the inner and outer shells of the outerpack is protected from pressurization through the use of vent plugs.

Every internal foam compartment within the outerpack is protected by at least one acetate vent plug that will melt in the event of a fire and allow the internal spaces to vent. As a result, no significant increase in pressure was observed during the testing. Therefore, the applicant does not anticipate a significant pressure increase in any HAC condition.

3.6.6 Maximum Thermal Stresses

Thermal stresses during HAC are provided in Section No. 2.7.4 of the application.

3.7 Thermal Tests

The HAC fire certification testing of the package served to verify material performance in the HAC thermal environment. As such, with the exception of the tests required for specific packaging components, as discussed in Section No. 8.1.4 of the application, specific acceptance tests for material thermal properties are not required or performed.

3.8 Evaluation Findings

Based on review of the statements and representations in the application, the staff concludes that the thermal design has been adequately described and evaluated, and that the thermal performance of the package meets the thermal requirements of 10 CFR Part 71.

4.0 CONTAINMENT EVALUATION

Not applicable.

5.0 SHIELDING EVALUATION

Not applicable.

6.0 CRITICALITY EVALUATION

6.1 Objective of the Review

The objective of the criticality review is to verify that the criticality performance of the package has been adequately evaluated for the tests specified under NCT and HAC, and that the package design satisfies the criticality requirements of 10 CFR Part 71.

6.2 Criticality Evaluation

The staff performed a criticality safety review of the proposed amendment request to (i) revise nominal dimensional parameters for the 16x16 ATOM fuel assembly, (ii) include secondary source rods and axial spacers as materials allowed for transport, (iii) specify that the only material with moderating effectiveness greater than full density water permitted for fuel assembly contents or fuel rods contents is a polyethylene sleeve used to protect the fuel assembly or the loose fuel rods inside a rod pipe, and (iv) allow fuel rods to be replaced with any number of solid stainless steel rods

The applicant revised its application to provide a rationale for some of these proposed modifications and included a supplementary criticality analysis to support the request to change the 16x16 ATOM fuel assembly nominal dimensional parameters.

The Westinghouse report LCPT-10-30, “Review of the Traveller STD and XL approval certificate USA/9297/AF-96 for Westinghouse Sweden PWR 16x16 fuel deliveries to customers in Germany,” October 21, 2010, was reviewed by staff (ADAMS Accession No. ML103230307).

The applicant noted that the CoC Rev. No. 4 showed in error a Nominal Pellet Diameter of 0.914 cm for a 16x16 ATOM fuel assembly while the correct design value is 0.911 cm. This value of 0.911 cm is used in the criticality safety evaluation for a 16x16 ATOM fuel assembly. The applicant also noted a value of 0.057 cm for the Nominal Guide Tube Wall Thickness, while the actual design value is 0.070 cm, and a value of 1.354 cm for the Nominal Guide Tube Outer Diameter versus an actual design value of 1.380 cm.

The deviations noted in the Nominal Guide Tube Wall Thickness and Outer Diameter are the result of a new skeleton design with stiffer guide tubes, which had not been incorporated into the CoC. The applicant did not perform any new criticality calculations for the guide tube change but stated that the increased thickness of the twenty guide tubes in the skeleton results in a small decrease in the volume of water in the fuel rod lattice for the cross sectional area of the assembly lattice, i.e., a reduction of 1.1 cm^2. Because the fuel lattice is under-moderated for all conditions of transport, any decrease in the volume of water due to the increased thickness of the guide tubes would result in a decrease in reactivity. Therefore, the applicant concluded that the increased guide tube thickness dimension does not significantly change the conclusions of the technical evaluations for the 16x16 ATOM fuel.

The applicant also requested the addition of secondary source rods as permitted non-fissile components, the replacement of fuel rods with any number of solid stainless steel rods, and the addition of polyethylene sleeves to protect either fuel assemblies or loose fuel rods inside a rod pipe. To justify these changes, the applicant stated that secondary source rods and solid stainless steel rods that may be placed in the fuel assembly are non-fissile material and thus would lower the water-to-fuel ratio in the fuel rod lattice. The fuel rod lattice is under-moderated for both NCT and HAC; therefore, the displacement of water from the guide tube locations by the secondary source rods causes k_{eff} to decrease. In addition to increasing neutron absorption, the solid stainless steel rods displace uranium rods from the fuel lattice, which also causes k_{eff} to decrease. Further, the use of polyethylene sleeves is bounded by previous analyses of the existing relatively large polyethylene blocks (as compared to the sheeting thickness) that surround the package contents. Also, the applicant analyzed for preferential flooding, with the bounding case being full moderation in the fuel assembly envelope and the remainder of the package dry. The analysis results were less than the upper subcritical limit.

The staff performed confirmatory analyses of the package using the CSAS26 sequence of the SCALE code system (*SCALE: A Modular Code System for Performing Standardized Computer Analyses for Licensing Evaluations*, ORNL/TM-2005/39, Version 6, Vols. I-III, January 2009) with the KENO VI three-dimensional Monte Carlo criticality transport program and 44-group ENDF/B-V cross sections. With assumptions similar to those used by the applicant under HAC conditions, the staff’s confirmatory calculations resulted in a maximum k_{eff} lower than what was reported in the application for increasing guide tube thickness. Therefore, the staff’s analyses confirm that the package will meet the criticality safety requirements of 10 CFR Part 71.

6.3 Evaluation Findings

Based on the staff’s evaluation of the applicant’s analyses, the staff has determined that the revised package contents will remain subcritical under all NCT and HAC conditions. Therefore, the staff concludes that the proposed changes are acceptable and do not affect the ability of the package to meet the requirements of 10 CFR Part 71.

7.0 OPERATING PROCEDURES

The applicant provided an updated section describing package operations. The updated operations included revisions of all sections to incorporate operating experience and more accurately represent the current package operations. Editorial changes were also made throughout Chapter No. 7 of the application. The staff reviewed the updated package operations and found them to be adequate.

8.0 ACCEPTANCE TESTS AND MAINTENANCE PROGRAM

The applicant provided an updated section describing the acceptance tests and maintenance program for the packaging.

The applicant revised various parts of Section No. 8.1.5, “Component and Material Tests,” to replace “poison plate” with the term “neutron absorber plate,” and replace “neutronics testing” with the term “neutron absorber testing” to standardize the reference to BORAL neutron absorber material. The applicant revised the thermal conductivity values of the foam, the sampling rates and test methods for aluminum alloys, neutron radiography, and transmittance for Boron areal density and chemical testing.

The applicant also added criteria for visual inspection of neutron absorber plates to Section No. 8.2.5, “Neutronic Absorber Plates.”

Based upon its review of the descriptions in the application, the staff concludes that the revisions to the acceptance tests and maintenance program, as presented in the application, meet the requirements of 10 CFR Part 71 and are acceptable.

CONDITIONS

The following changes have been made to the Certificate:

Item No. 3.b was modified to reference the consolidated application dated June 17, 2011.

Condition No. 5(a)(2) was revised to describe the changes made to the package design.

Condition No. 5(a)(3) was revised to list the latest revision of the licensing drawings, 10004E58, Rev. 6 (sheets 1-9) and 10006E58, Rev. 5.

Condition No. 5(b)(1)(i) was revised to include the new nominal dimensional parameters for the 16x16 ATOM fuel assembly type.

Condition No. 5(b)(1)(ii) was revised to allow the shipment of secondary source rods and axial spacers.

Condition No. 5(b)(iv) was revised to include polyethylene sleeves as protection for the fuel assemblies.

Condition No. 5.(b)(1)(vi) was added to allow the replacement of fuel rods with any number of solid stainless steel rods.

Condition No. 9 was revised to authorize the use of the previous revision of the CoC until June 30, 2013, per the applicant's request dated June 1, 2011.

The expiration date of the certificate has not changed. The certificate references the Westinghouse Electric Company, LLC, consolidated application dated June 17, 2011.

CONCLUSION

Based on review of the statements and representations in the application, as supplemented, the staff concludes that the design has been adequately described and evaluated and that the Model Nos. Traveller STD and Traveller XL packages meet the requirements of 10 CFR Part 71.

Issued with Certificate of Compliance No. 9297, Revision No. 5,
on July 6, 2011.