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SUBJECT: Review of the Traveller STD and XL approval certificate
USA/9297/AF-96 for Westinghouse Sweden PWR 16X16 fuel deliveries to
customers in Germany

Summary

Reviews of the Traveller STD and XL approval certificate USA/9297/AF-96 for Westinghouse Sweden PWR 16X16 fuel deliveries to customers in Germany are documented in BTK 06-0657. These reviews document deviations in design values for some fuel assembly parameters from the nominal values in the approval certificate for 16X16 ATOM fuel assembly. The first review done on 13 June 2008 (BTK 06-0657, rev. 0) notes that the "Nominal Pellet Diameter" in the approval certificate is 0.914 cm and the more correct design value is 0.911 cm. The second review done on 14 June 2010 (BTK 06-0657, rev. 1) notes an additional deviation as the "Nominal Guide Tube Wall Thickness" in the approval certificate is 0.057 cm that should be design value of 0.070 cm, and the value for "Nominal Guide Tube Outer Diameter" is 1.354 cm should be the design value of 1.380 cm. The "Nominal Pellet Diameter" deviation is an error in the value recorded in the approval certificate. The correct design value for the "Nominal Pellet Diameter", 0.911 cm, is used in the technical criticality evaluation for the 16X16 ATOM fuel assembly. The "Nominal Guide Tube Wall Thickness" and "Nominal Guide Tube Outer Diameter" deviations are the result of a new the skeleton design with stiffer guide thimble tubes. The change to the skeleton design was not incorporated into the approval certificate, but the increased guide tube thickness dimension does not significantly change the conclusions of the technical evaluations for the 16X16 ATOM contents.

Background

The fuel assembly technical data from the skeleton reference design for KWG (AA 273 720, MAßBLATT KWG 16X16 Brennelement) and the report "Transport of Maximum Eight Fresh PWR 16x16 Fuel Elements Containing at Most One BA-free Bundle" (BCP 97-082) were used for the 16X16 ATOM fuel assembly technical evaluations for the Traveller package.

"Nominal Pellet Diameter"

The pellet diameter from the fuel assembly technical data is 9.11 mm. This metric value for the pellet diameter was converted to English units as 0.359 in. by rounding up from a more precise value of 0.35866. The value of 0.359 inches was used in the computer code for the criticality evaluation and converted back to metric units as 0.91186 cm. The technical evaluation used the

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larger value of 0.91186 resulting from the unit conversions and rounding to represent the design value of 0.911 cm. Each fuel assembly type is evaluated to compare reactivity of the fuel assemblies in a condition representative of the accident transport conditions. The 17OFA fuel assembly type is the most reactive fuel assembly and is used as the reference contents for the package criticality evaluation. The difference of 0.00086 cm does not have a significant effect on the results for the criticality evaluation of the fuel assemblies.

A draft of the approval certificate USA/9297/AF-96 (DRAFT) recorded the "Nominal Pellet Diameter" as 9.1186 mm (0.3590 in) used in the criticality evaluation. Westinghouse requested that the NRC issue the approval certificate with the dimensions specified to the precision of 0.001 in and 0.001 cm provided dimensions that were rounded up to the nearest 1/1000. The reference dimension for the 16X16 ATOM pellet diameter was changed in this review process from 0.359 inch to 0.360, but there is no documented record of the reason for this change. The value of 0.360 in was converted to metric units as 0.914 mm instead the design dimension used in the technical evaluation.

"Nominal Guide Tube Wall Thickness" and "Nominal Guide Tube Outer Diameter"

The guide tube outer diameter, 13.54 mm, and guide tube inner diameter, 12.4 mm, are specified in the fuel assembly technical data. The guide tube thickness is derived from the difference between the outer and inner diameters as 0.057 mm. The design value for the guide tube wall thickness, 0.57 cm, and guide tube outer diameter, 1.354 cm, were used in the computer code for the criticality evaluation. A design change was made to increase the stiffness of the guide thimble tubes by increasing the thickness of the tube from 0.057 mm to 0.070 mm. This design change was not reviewed for the effect on the technical evaluations for the package approval. A review of the Traveller STD and XL approval certificate USA/9297/AF-96 was done after the guide tube design change was approved. This review for Westinghouse Sweden PWR 16X16 fuel deliveries to customers in Germany noted deviations in the design dimensions for the guide tube from approval certificate as the result of the new the skeleton design with stiffer guide thimble tubes.

The increased thickness of the twenty guide thimble tubes in the skeleton results in a small decrease, 1.1 cm^2 , in the volume of water in the fuel rod lattice. The fuel lattice is under moderated for all conditions of transport; hence, any decrease in the volume of water would result in a decrease in reactivity. This effect is of any change in water volume due to small changes in the guide tube dimensions is marginal due to the absence of any fissile material in the guide tube cells within the fuel rod lattice. The guide tubes in the reference fuel assembly, 17X17 W-OFA did not buckle during the impact tests performed on the package. Hence, the guide tubes did not absorb any significant energy from the impacts and change in dimensions of the guide tubes are not significant to the structural performance of the package during the impact tests.

Conclusions

Table 1 summarizes the deviations for the 16X16 ATOM fuel assembly technical data from the package approval documents.

Table 1 – Parameters for 16X16 ATOM Fuel Assembly

	Package Approval Documents		Fuel Assembly Technical Data	
	Safety Analysis Report Technical Evaluation	US DOT Competent Authority Certificate USA/9297/AF-96, rev 3	Reference Design for KWG	Skeleton Design Change
Nominal Pellet Diameter	0.9118 cm (0.359 in.)	0.914 cm (0.360 in.)	9.11 mm	No change
Nominal Guide Tube Wall Thickness	0.0570 cm (0.0225 in.)	0.057 cm (0.023 in.)	0.57 mm	0.70 mm
Nominal Guide Tube Outer Diameter	1.3541 cm (0.5331 in.)	1.354 cm (0.533 in.)	13.54 mm	13.80 mm

The criticality evaluation for the 16X16 ATOM fuel assembly type was done using the correct design value of 9.11 mm for the “Nominal Pellet Diameter”. The dimension of 9.14 cm on the approval certificate is a deviation that is due to recording an incorrect value for the pellet diameter.

The design change that increased the “Nominal Guide Tube Wall Thickness” has no significant effect on the criticality and structural evaluations for the package.

Although the design dimensions for the “Nominal Pellet Diameter”, “Nominal Guide Tube Wall Thickness”, and “Nominal Guide Tube Outer Diameter” deviate from the values in the approval certificate, there is no significant safety significance that prevents using the current approval certificate to transport the current 16X16 ATOM fuel in the Traveller package. These dimensions will be changed to the more correct design values in the next revisions to the Traveller safety analysis report and approval certificates.

Sincerely,

** Electronically approved*

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