

November 24, 2004

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. 6078 FOR THE MODEL NOS. 927A1  
AND 927C1 PACKAGES

Dear Mr. Kent:

As requested by your application dated August 9, 2004, enclosed is Certificate of Compliance (CoC) No. 6078, Revision No. 30, for the Model Nos. 927A1 and 927C1 packages. This certificate supersedes, in its entirety, Certificate of Compliance No. 6078, Revision No. 29, dated September 24, 2001. 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.

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/

John D. Monninger, Chief  
Licensing Section  
Spent Fuel Project Office  
Office of Nuclear Material Safety  
and Safeguards

Docket No. 71-6078  
TAC No. L23759

Enclosures: 1. Certificate of Compliance No. 6078, Rev. No. 30  
2. Safety Evaluation Report

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

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## **SAFETY EVALUATION REPORT**

**Docket No. 71-6078**  
**Model Nos. 927A1 and 927C1 Packages**  
**Certificate of Compliance No. 6078**  
**Revision No. 30**

### **SUMMARY**

By application dated August 9, 2004, Westinghouse Electric Company requested an amendment to Certificate of Compliance (CoC) No. 6078 for the Model Nos. 927A1 and 927C1 packages. Specifically, Westinghouse requested to modify the authorized contents in the CoC. This revision includes adding a new type of unirradiated (fresh) fuel assembly type to the authorized contents of the package, and modifying several parameters of the fuel currently authorized.

The amendment request included the necessary engineering analyses and proposed CoC and application page changes. The proposed application changes will be incorporated into the package application and referenced in the CoC.

The U.S. Nuclear Regulatory Commission (NRC) staff has reviewed the amendment request, including the proposed CoC and application revisions, and other supporting documents submitted with the amendment request. Based on the statements and representations in the application, as supplemented, the staff concludes that the Model Nos. 927A1 and 927C1, as amended, meet the requirements of 10 CFR Part 71.

### **1.0 GENERAL INFORMATION**

The applicant requested to revise Condition 5 of the CoC, "Contents," to include a new fuel type as authorized contents, and to make changes to several fuel parameters specified in Conditions 5(b)(1)(ii), (iii), and (v). 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 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 staff performed a criticality safety review of the proposed amendment to CoC No. 6078 for the Model Nos. 927A1 and 927C1 shipping packages that modified various fuel characteristic parameters to accurately reflect the package contents. There were no design changes to the packaging. The CoC currently authorizes six (6) different fuel types, of which three (3) are modified in this amendment. The modifications requested include pellet density, fuel

enrichment, pellet diameter, and the addition of annular pellet zones. In addition, the applicant requested the addition of a new 16x16 fuel type that is similar in configuration to those already authorized under the existing CoC. The staff evaluated the proposed modifications and the addition of the new fuel type based on information provided in the amendment request, which includes suggested revisions to the CoC and a revised Criticality Safety Evaluation.

The applicant performed criticality safety calculations for each fuel type that was modified as well as the new fuel type. Contents were modeled under normal and hypothetical accident conditions and evaluated as individual packages and as a 2x4x1 package array. In all instances, the calculated effective multiplication factor ( $k_{\text{eff}}$ ) was below the upper subcritical limit (USL) of 0.9377.

For the 14x14 fuel, the calculated  $k_{\text{eff}}$  increased slightly due to the increased enrichment and pellet density, however this increase is bounded by the new 16x16 fuel type. The two 16x16 fuel types that reduced the pellet diameter from 0.330 inches to 0.325 or 0.3255 inches had been previously approved at the smaller diameter in an previous revision to the CoC. However the fuel had been evaluated at a lower pellet density. The analysis of the new pellet density demonstrates that the  $k_{\text{eff}}$  for these fuel types are bounded by those of the new 16x16 fuel type.

The new 16x16 fuel type, described in Condition 5(b)(1)(vii) of the CoC, has the highest reactivity of all the fuel types allowed in the Model Nos. 927A1 and 927C1 shipping packages. For this fuel type, the applicant calculated its multiplication factor ( $k_{\text{eff}} + 2\sigma$ ) was equal to 0.9357. This fuel type is nominally similar to the previously most reactive 16x16 fuel type that was analyzed in the last revision of the CoC, with an increased volume ratio of water to  $\text{UO}_2$  in the unit cell, a lower density of  $^{235}\text{U}$ , and slightly lower total  $^{235}\text{U}$  per assembly.

The staff reviewed the submitted documentation, the SCALE4.4 code calculations, and the results supplied by the applicant and determined that the applicant included conservatism in the modeling parameters for both normal and hypothetical accident conditions. In all instances, the models were consistent in their assumptions and the maximum calculated  $k_{\text{eff}}$ s were found to be below the USL when the code biases and uncertainties were added. These conditions ensure an adequate margin of safety.

The staff performed confirmatory calculations of the most reactive hypothetical accident conditions using the KENO V.a code and the 44-group ENDF-5 cross section set in the SCALE 4.4a code system. The results of these confirmatory calculations were consistent with those performed by the applicant. In all instances, the calculated  $k_{\text{eff}}$  was found to be below the USL of 0.9377. The staff's analysis confirms that the package contents, as amended, will remain subcritical under normal and accident conditions of transport.

Based on the staff's evaluation of the applicant's models and analyses, the staff has determined that the revised package contents will remain subcritical under all normal and accident conditions of transport. Therefore, the staff concludes that modifying the three fuel types indicated above, the addition of the new 16x16 fuel type, and the proposed changes to the CoC are acceptable and do not affect the ability of the package to meet the requirements of 10 CFR Part 71.

## CONDITIONS

The following conditions in CoC No. 6078, Revision No. 30, have been revised as follows:

Conditions 5(b)(1)(ii), (iii), and (v) have been revised to include a specification that authorizes the use of fuel rods with annular pellet zones. The condition also states the specific design parameters for these annular pellets.

Condition 5(b)(1)(ii) has been revised to increase the maximum fuel enrichment from 4.76 w/o to 5.0 w/o U-235, and to increase the weight of U-235 per fuel bundle to 20.5 kg.

Condition 5(b)(1)(iii) and (v) have been revised to change the diameter of the uranium dioxide pellets from 0.33" to either 0.325" or 0.3255".

Condition 5(b)(1)(vii) has been added to the CoC to include a new type of 16x16 unirradiated fuel bundle.

Condition 7 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).

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.

## CONCLUSIONS

In addition to reviewing the changes to CoC No. 6078 against the applicable standards for each technical area, the staff also reviewed the proposed changes against the provisions of 10 CFR 71.19. The provisions in 10 CFR 71.19 impose additional requirements for previously approved packages, including Type AF packages approved by NRC before September 6, 1983. Specifically, 10 CFR 71.19(d)(2) states that modifications to the design or contents of a fissile material package will only be approved if the modifications are not significant with respect to the prevention of criticality. The staff has evaluated the changes requested by the applicant and determined that they meet the requirements of 10 CFR 71.19.

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. 6078, Revision No. 30,  
on November 24, 2004.