Enclosure 3 to TN E-34228

Changed Pages of the TN-LC
Safety Analysis Report, Revision 6,
Associated with this Supplemental Submittal
(Public Version)

1.1.2 Licensing Approach for the TN-LC Package

Proprietary Information on Pages 1-2 and 1-3
Withheld Pursuant to 10 CFR 2.390.

Appendix 2.13.11
TN-LC Fuel Assemblies and Fuel Elements under Impact Loads

NOTE: References in this Appendix are shown as [1], [2], etc., and refer to the reference list in Section 2.13.11.7.

Section 1.1.2 of Chapter 1 provides the licensing basis for high burnup commercial fuel with zirconium-based *fuel* cladding and for research reactor fuel. The structural integrity of the TN-LC payload fuel assemblies and fuel elements during NCT side and end drops are evaluated in this appendix. The analyses performed and results obtained form the basis to conclude that the fuel assemblies and fuel elements will maintain their structural integrity during normal conditions of transportation.

The effect of radial hydrides in high burnup commercial spent fuel cladding has been studied [16 and 17] during the last decade. These studies included ring compression tests to determine cladding ductility at various burnups and temperatures for different types of cladding. As a result of these tests, Aomi [17] concluded that the presence of radial hydrides has an impact on circumferential material properties and has no effect on longitudinal mechanical properties. Therefore, the bending (longitudinal) stresses caused by side and end drops, which are the most likely loads to cause gross deformation, are evaluated using material properties established in References [2] and [8]. Static and dynamic analyses are performed for side and end drop conditions, respectively, to determine the maximum stress in the cladding. The results of these analyses provide for a minimum safety factor of 1.57 to yield strength, which occurs in the 9x9 BWR fuel assembly for side drop (Table 2.13.11-8). Due to this large margin, it is concluded that the fuel will maintain its structural integrity during normal conditions of transport.

Similarly, the material properties for the research reactor fuel, conservative assumptions were made in the conjecturing of the material properties, thus giving credence to the conclusion of fuel integrity during NCT loads.

Proprietary Information on Pages 2.13.11-2 and 2.13.11-3
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