Nuclear Operating Company

South Texas Project Electric Generating Station P.O. Box 289 Wadsworth, Texas 77483

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U. S. Nuclear Regulatory Commission
Attention: Document Control Desk
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South Texas Project
Units 1 and 2
Docket Nos. STN 50-498, STN 50-499
Response to NRC Question on New Fuel Design

Reference: Letter to Mr. William T. Cottle, South Texas Nuclear Operating Company, from Mr. T. Alexion, Nuclear Regulatory Commission, dated March 11, 1998 (AE-NOC-0110)

The South Texas Project (STP) is responding to questions from the NRC in the referenced letter. Following the issuance of the amendments allowing STP to implement P+ fuel (ZIRLO™ with protective bottom grids), questions have been raised from within the NRC staff regarding the potential for atypical fuel rod bowing to occur with this design due to the placement of fuel rods near the bottom nozzle. The NRC staff suspects that the possibility exists that fuel rod bowing behavior with the new fuel can be significantly different from other Westinghouse designs due to the longer fuel rod length and the additional mid-grid.

Westinghouse has employed the P-grid design on many 12 foot fuel designs for the 17x17 and 15x15 arrays since the early 1990s. The 17x17 applications have included both the "Standard" fuel rod diameter designs (.374 inch - the same as the South Texas fuel rod diameter) as well as the "Optimized" fuel rod diameter designs (.360 inch fuel rod diameter) using both ZIRLO and Zr-4 fuel rod and structural materials. Experience has shown that increased propensity for fuel rod bow does not exist. The chief reasons for this lie in the in-reactor behavior of the zircaloy mid-grids and the optimization of grid spring forces on the top and bottom Inconel grids.

As a result of the study of fuel growth behavior through the different generations of fuel designs, the current Westinghouse fuel designs employ a high force bottom Inconel grid and a reduced force top Inconel grid. The zircaloy mid-grid spring forces relax due to thermal and irradiation effects very quickly, leaving the top and bottom Inconel grids as the main actors in influencing fuel assembly and fuel rod growth dynamics. The grid spring forces in the top grid have been minimized to allow the fuel rods to slip through the grid as they grow rather than bow. This behavior and response of the fuel rods has been confirmed through field measurements of fuel rod growth and position on outer faces of fuel rods.

The fuel design employed for the STP units is within the Westinghouse experience base for fuel rod bow experience, even though it is a two foot longer design. The fuel rods are .374 inch diameter which is stiffer than the .360 inch diameter design for 12 foot fuel for which acceptable performance has been demonstrated. The grid span lengths are somewhat smaller as compared to the 12 foot fuel designs, hence, the degree of support for any individual span is greater than the Westinghouse 12 foot fuel experience base. Some of the 12 foot fuel assemblies (for both the .360 inch and .374 inch fuel rod diameters) utilize three Integral Flow Mixer (IFM) spacers which provide some additional frictional resistance to fuel rod growth while the 14 foot fuel designs do not employ this feature. Finally, the South Texas fuel product uses ZIRLO for the fuel rod and skeleton structures which grows at about half the rate as Zr-4 fuel. This means that the level of compressive forces applied to the fuel rod due to growth effects will be much less than that experienced by similar designs fabricated from Zr-4 alloys for which rod bow performance has been found to be acceptable.

In conclusion, Westinghouse and the South Texas Project staff believe the inclusion of the protective bottom grid and the accompanying change in fuel rod position for the STP fuel design will not result in increased levels of fuel rod bow. Typical Post Irradiation Examination (PIE) activities include visual inspection and videotaping of selected fuel assemblies and these will be performed as part of the STP fuel follow activities.

If you have any questions on this matter, please contact D. F. Hoppes at (512) 972-8132 or me at (512) 972-7795.

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