GNF
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November 10, 2004

FLN–2004–032

Document Control Desk
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Washington, DC 20852–02738

Attention: Mel B. Fields

Subject: Shadow Corrosion Effects on SLMCPR Channel Bow Uncertainty

Reference: 1. Letter JS Post (GENE) to Document Control Desk (NRC), "Part 21 Notification: Fuel Channel Bow Reportable Condition and 60-Day Interim Notification," MFN 03-012, March 3, 2003

2. Letter JS Post (GENE) to Document Control Desk (NRC), "Part 21 Notification: Channel Bow Thermal Limits Impact, GNF-A Thick/Thin Fuel Channels, BWR 2-5 Plants," MFN 03-038, June 6, 2003

In 2003, GNF concluded that the presence of shadow corrosion on BWR fuel channels could potentially impact BWR/6 margin to safety. (Reference 1) Additionally, GNF found that sufficient margin to safety existed in BWR/2-5 plants. (Reference 2). The data and evaluation process were discussed with the U.S. NRC on June 11-12, 2003.

In the evaluations of Reference 1 and 2, the impact of shadow-corrosion induced bow on the SLMCPR was explicitly considered. The compensatory increase in R-factor uncertainty was assessed as generically having an adverse impact of less than [[ ]] on the calculated SLMCPR. [[ ]]

At this time, GNF has generically increased the GEXL R-factor uncertainty used in the SLMCPR analysis from [[ ]] to account for the potential impact of control

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blade shadow corrosion induced bow. This conservative application had been made for all plant applications, although shadow corrosion has only been identified at S-lattice (BWR/6) and C-lattice plant types. There is no evidence of shadow corrosion for D-lattice plants.

This note serves to document the process for increasing the standard R-factor uncertainty [[ ]].

Background

The cycle-specific SLMCPR analysis performed for previous cycles includes a GEXL R-factor uncertainty of [[ ]]. One of the components of this uncertainty is an allowance for the uncertainty in the channel bow. The [[ ]] value incorporates coverage of a core-average cell-average uncertainty of up to [[ ]]. This R-factor uncertainty is documented in GESTAR II Revision 23 Table 6-1 and is generic to all fuel product lines.

Recently, significant channel bow towards the control blade has been observed in some "C" and "S" (BWR/6) lattice plants. As detailed in Reference 1 and 2, a mechanism for this new and unexpected bowing has been identified as control blade induced shadow corrosion. The combination of fluence induced channel bow and shadow corrosion induced bow changes the possible spread of the population of cell average channel bows in a given core design. The evaluation demonstrated that while the presence of shadow corrosion increased the uncertainty in core average cell average bow, the uncertainty was less than [[ ]] mils. The histogram of all evaluations performed is contained in the figure below. The impact of increasing the channel bow uncertainty [[ ]] is now explained.

[[

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R-factor Uncertainty Calculation Process

The process used to define the R-factor uncertainty as applied in the evaluation of the Safety Limit Minimum Critical Power Ratio (SLMCPR) was developed in connection with the approval of the revised methodology ("Methodology and Uncertainties for Safety Limit MCPR Evaluations," NEDC-32601P-A, dated August 1999) and the reduced uncertainties ("Power Distribution Uncertainties for Safety Limit MCPR Evaluations, "NEDC-32694P-A, dated August 1999). The R-factor uncertainty is comprised of [[

]] and finally a channel bow uncertainty component.

[[

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Channel Bow Uncertainty Component

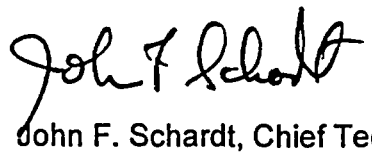
The channel bow uncertainty bases for GNF channels is [[
]] Analysis of channel bow statistics which include the additional shadow corrosion bow component yields a maximum cell-averaged bow [[

]] This higher component due to channel bow uncertainty leads to an overall R-factor uncertainty of [[ ]]

Conclusion

Following the method for statistical combination of uncertainties in Appendix C of NEDC-32601P-A, the standard GEXL R-factor uncertainty has been increased [[
]]. The new criterion covers a core-average, cell-average standard deviation in bow of up to [[ ]] mils. Compared with the original GNF R-factor uncertainty of [[ ]], the SLMCPR consequence is determined to be approximately [[ ]].

Sincerely,



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