PDR

October 19, 1992

R. A. Copeland, Manager
Reload Licensing
Siemens Power Corporation
2101 Horn Rapids Road, P.O. Box 130
Richland, WA 99352-0130

Subject: Request for Additional Information on Topical Report ANF-90-082-P, Revision 1, "Application of ANF Design Methodology for Fuel Assembly Reconstitution"

Dear Mr. Copeland:

The review of topical report ANF-90-082-P, Revision 1 is currently in progress. During the course of our review, the staff has identified the need for some additional information as indicated in the enclosure.

Please contact E. D. Kendrick of my staff on (301) 504-2891 if there are any questions concerning this request.

Sincerely,

Robert C. Jones, Chief
Reactor Systems Branch
Office of Nuclear Reactor Regulation

Enclosure:
As stated

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QUESTIONS ON SIEMENS NUCLEAR POWER CORPORATION'S TOPICAL REPORT ANF-90-082, REVISION 1, ENTITLED "APPLICATION OF ANF DESIGN METHODOLOGY FOR FUEL ASSEMBLY RECONSTITUTION"

The following questions have been divided into three categories: those generic to boiling-water reactor (BWR) and pressurized-water reactor (PWR) reconstituted assemblies, those specific to BWR reconstituted assemblies, and those specific to PWR reconstituted assemblies. Many of these questions are due to the fact that no analyses have been presented in the subject report that substantiate the claims and conclusions of this report.

Generic Reconstituted Assemblies

1. Please provide analyses that quantify the following two effects of the use of reconstituted assemblies on the peak cladding temperatures (PCTs) for small and large-break loss-of-coolant accidents (LOCAs) for both BWR and PWR designs:

   1a. The possible increase in PCT due to the placement of a reconstituted assembly (with the maximum number of inert replacement rods) next to the hot assembly for which PCT is calculated. These BWR and PWR analyses should include changes in water density and cross flow (not applicable for BWR assembly) due to the presence of the reconstituted assembly.

   1b. The increase in PCT due to an increase in the average linear heat generation rate of the remaining fuel rods in the core due to the presence of the maximum possible number of inert replacement rods in a BWR and PWR core.

2. In Section 3.0, page 3, it is stated that typically the number of inert (non-fueled) replacement rods per assembly do not exceed a particular number for BWRs and PWRs. Are these numbers an upper limit on the number of inert replacement rods per assembly for SNPC designs? If not, what are the maximum number of inert replacement rods per assembly for BWRs and PWRs? Please provide justification for these numbers based on the minimum critical power ratio (MCPR) for BWRs and departure from nucleate boiling ratio (DNBR), applicability of critical heat flux (CHF) correlations, local power peaking effects, and assembly liftoff.

3. Please discuss the impact of using the maximum number of replacement rods on reconstituted assembly and rod forces due to seismic loss-of-coolant accident (LOCA) events for both BWRs and PWRs. Please compare assembly and rod forces from a BWR and PWR reconstituted assembly to those from a BWR and PWR non-reconstituted assembly, respectively, due to the changes in assembly stiffness, frequency, weights, and spacer grid strength and stiffness of the BWR and PWR reconstituted assemblies. Also, please discuss assembly liftoff for BWR reconstituted assemblies.

does this compare to the maximum number of inert rods in a reconstituted assembly?

PWR Reconstituted Assemblies

9. What is the maximum possible increase in local power on a neighboring PWR fuel rod due to a) the insertion of one non-fueled rod, and b) the insertion of two adjacent and/or diagonally-adjacent non-fueled rods? Does SNPC intend to calculate local rod power peaking effects due to the presence of adjacent non-fueled rods and include these peaking effects in their analyses for each PWR reconstituted assembly application?

10. In Section 4.2.2, it is claimed that the "analysis of the standard PWR assembly without the inert replacement rod bounds an assembly with one or more inert rods because of the effect of the inert rod upon the assembly power...The reduction in the assembly power would result in an increase in the DNBR for the peak power rod at the Technical Specification Limit." This conclusion is unsupported by any analysis because, as stated in the subject report, DNBR is dependent on local subchannel conditions for PWR assemblies. For example, removing a fuel rod from a PWR fuel assembly and replacing it with an inert rod decreases the total power production by only about 0.5%, but as a result, the local power peaking may increase in nearby fuel rods due to the presence of adjacent inert rod(s) (see Question 9 above). Therefore, it is by no means obvious that the local subchannel conditions in a PWR assembly will always be moved farther away from DNB (as compared to the standard assembly) by the removal of one or more power-generating rods if the same total core power is to be maintained.

 10a. What happens to the location of the hot channel in the bundle taking into account the new radial power distribution resulting from the presence of the inert replacement rods? What is the effect on the location when additional inert rods are added including adjacent and diagonally-adjacent inert rods? Please provide analyses to show how this affects the minimum DNBR.

 10b. Are the local conditions in the hot channel still within the range of applicability of the XNB and ANFB DNB correlations after rod replacement? What criteria are used to make this determination?

 10c. What is the range of radial power peaking factors in the data bases of the XNB and ANFB correlations and how does this compare to the maximum power peaking in assemblies with replacement rods?

 10d. How are cold wall effects modeled in these two correlations, particularly when there are two adjacent and/or diagonally-adjacent inert replacement rods? What is the sensitivity of these correlations to the cold wall effect? What is the range of channel hydraulic diameters (based on heated as well as wetted perimeter) that the correlation is applicable to? Are there CHF data available to demonstrate that these correlations are applica-