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SHOREHAM NUCLEAR POWER STATION

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March 15, 1982 SNRC-679

Mr. Harold Denton, Director
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Safety Evaluation Report - Licensing Condition No. 2
Fission Gas Release, Ballooning and Rupture
Shoreham Nuclear Power Station - Unit 1
Docket No. 50-322

References:

1) NEDE 23785-1-P "GESTR-LOCA and SAFER Models for the Evaluation of the Loss of Coolant Accident," Revision 1, December 1981, Volumes 1 and 2

2) NEDE 23786-1-P "Fuel Rod Prepressurization - Amendment 1," May 1978

3) Letter from R. H. Bucholz (GE) to L. S. Rubenstein (NRC), General Electric Fuel Clad Swelling and Rupture Model," May 15, 1981

4) Letter from J. F. Quirk (GE) to L. S. Rubenstein (NRC), "General Electric Analytical Model for Calculation of Cladding Rupture Strain and Maximum Local Oxidation in LOCA Analysis," October 19, 1981

5) Letter from J. F. Quirk (GE) to L. S. Rubenstein (NRC), "General Electric Analytical Model for Calculation of Local Oxidation in LOCA Analysis," September 14, 1981

Dear Mr. Denton:

The Shoreham Nuclear Power Station - Unit 1 Safety Evaluation Report (SER), Supplement No. 1 states in Sections 4.2.3.2 and 4.2.3.3 that the Shoreham license will be conditioned to require ECCS reanalysis for second cycle and beyond utilizing models that (1) account for effects of high burnup fission gas release and prepressurized fuel, (2) accommodate the information in NUREG-0630, including its effects on local oxidation, and (3) have been reviewed

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and approved by the NRC. LILCO has determined that this licensing condition is unwarranted, and that no further analysis is necessary. The following provides our basis for this determination.

Effects of Fission Gas Release and Prepressurized Fuel

An improved fission gas release (FGR) model was submitted to the NRC for review as part of General Electric's overall fuel performance code (Reference 1, Volume I) in December 1981. Concurrent with the submittal of the improved fuel performance model, GE submitted an improved ECCS evaluation model (Reference 1, Volume II) based on more realistic loss-of-coolant accident (LOCA) analysis methods and inputs. Use of the combined realistic ECCS evaluation model and improved fuel performance (FGR) model has been shown to provide large margins in calculated PCTs. The NRC approval of the models is expected by December, 1982.

The ECCS Calculations for Shoreham were done using the current GE evaluation model with the older fission gas release model. The calculated PCT was within the 10CFR50.46 limit of 2200°F. Any calculations performed using the realistic ECCS model with the latest FGR correlation would predict PCTs substantially lower than the current analysis. Therefore, a specific reanalysis for the Shoreham plant using the latest FGR model is not necessary. A GE licensing topical report (Reference 2) showed that the use of prepressurized fuel in the BWR reduced the calculated PCT by 0°F to 60°F. Since the current Shoreham ECCS analysis predicts PCT values less than 2200°F a reanalysis accounting for prepressurized fuel would only provide improved margin and is not justified.

Fuel Cladding Swelling and Rupture (Including Local Oxidation)

General Electric has performed several generic studies to address the NRC concern related to the fuel cladding swell and rupture model utilized in the current GE-BWR evaluation model for loss-of-coolant accident (LOCA) analyses. The results of those studies have been submitted to the NRC (see References 3, 4, and 5). Although their review is not yet complete, the NRC staff has agreed verbally with GE on the content of the report, and all of the key issues are believed resolved.

The submitted studies show that no changes to the current GE fuel cladding swell and rupture model are required to meet 10CFR50 Appendix K requirements for loss-of-coolant accidents. Key points from these studies are listed below:

1. The GE model conservatively bounds 90% of all experimental data relevant to BWR conditions. This data base includes results from GE experiments, as well as from NUREG-0630 and other sources (see Reference 3) which were obtained under conditions prototypical of the BWR (i.e., cold shroud, slow heatup rates).

2. Sensitivity studies were run to determine effects of increased rupture strain on the peak cladding temperature (PCT). These studies were performed using a base case plant with a long reflood time and a short blowdown period which was bounding for all BWRs. The majority of the studies were performed using prepressurized 8x8 fuel as used in Shoreham.

3. Several different sensitivity studies were performed to compare the effects of various bundle location configurations of high rupture strains to the results from the current model. The high strain cases were also compared to modified base cases to assure similar percentages of flow blockages.

4. All the studies show decreases in PCT (up to 40^{o}F) with the higher rupture strains. The reduction in PCT is due mainly to the increased heat transfer area available at the higher strains for the ruptured rods.

5. Zircaloy oxidation heating has always been accounted for in current GE model (see Reference 5). In these sensitivity studies, it was shown that any temperature increase due to increased zircaloy oxidation heating for the case of higher strain was more than offset by the improved heat removal from the rods due to larger surface area.

6. In these sensitivity studies, it was shown that increasing the maximum perforation strain had an insignificant effect on the calculated maximum local oxidation fraction, i.e., a greater than 50% increase in strain amounted to only a 5% increase in the calculated local oxidation fraction. The reason for this small sensitivity is the decrease in cladding temperature as a result of the larger strain.

These studies submitted to the NRC justify continued use of the current General Electric cladding swelling and rupture model for BWR LOCA analysis. No changes to that model are necessary to meet the 10CFR50 Appendix K requirements.

Models Reviewed and Approved by NRC

The Shoreham ECCS calculations were done with General Electric's current evaluation model which has been reviewed and approved by the NRC.

Reanalysis with more realistic GE models will only provide increased PCT margin for Shoreham. This reanalysis requirement is therefore unnecessary and should be removed from the licensing condition.

Please advise if you have any questions or require additional information.

Very truly yours,

J. L. Smith

J. L. Smith
Manager, Special Projects
Shoreham Nuclear Power Station

RWG:mp

cc: J. Higgins