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Division of Information Support Services (Post 890205)

SUBJECT: Requests NRC review & approval of irradiation of lead test assembly in plant.Nonproprietary Rept EMF-212 & proprietary Reports EMF-208(P),EMF-212(P) & EMF-122(P) encl.Proprietary See repts withheld,per 10CFR2.790(b).

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CP&L

Carolina Power & Light Company

MAR 15 1993

SERIAL: NLS-93-077
10 CFR 50.59

United States Nuclear Regulatory Commission
ATTENTION: Document Control Desk
Washington, DC 20555

H. B. ROBINSON STEAM ELECTRIC PLANT, UNIT NO. 2
DOCKET NO. 50-261/LICENSE NO. DPR-23

UNREVIEWED SAFETY QUESTION - LEAD TEST ASSEMBLY

Gentlemen:

The purpose of this letter is to request NRC review and approval of the irradiation of a lead test assembly in the H. B. Robinson, Unit No. 2 Steam Electric Plant (HBR2).

A reconstituted high burnup lead test assembly was inserted into HBR2 during Cycle 15 under the provisions of 10 CFR 50.59. The goals of the program are to validate Siemens Power Corporation design methods with respect to bundle growth, rod growth, oxide accumulation, internal pressure, and other limiting fuel assembly and fuel rod parameters at peak rod burnups exceeding the current licensed analysis limit of 62 GWD/MTU. Carolina Power & Light Company (CP&L) has determined that continued irradiation in Cycle 16 (scheduled to begin in November 1993) will constitute an unreviewed safety question since the assembly will exceed the NRC-approved peak rod burnup analysis limit of the Siemens' methodology. An analysis and discussion of the lead test assembly is included as Enclosure 1 to this letter. Carolina Power & Light Company requests NRC concurrence with this program by June 1, 1993 to allow continued irradiation of the assembly in Cycle 16.

Siemens Power Corporation considers the information contained in Enclosures 3, 5, and 6 to be proprietary. Therefore, in accordance with the requirements of 10 CFR 2.790(b), an affidavit is enclosed (Enclosure 2) to support the withholding of these documents from public disclosure.

A001
1/1
NRC PDR } w/out Prop Encls
NSIC

411 Fayetteville Street • P. O. Box 1551 • Raleigh, N. C. 27602

(1958RNP)

Questions regarding this matter may be referred to Mr. R. W. Prunty at (919) 546-7318.

Yours very truly,

David C. McCarthy

David C. McCarthy
Manager
Nuclear Licensing Section

JSK/jbw

Enclosures
1. Safety Analysis
2. Affidavit for Proprietary Reports
3. EMF-91-212(P), Supplement 1, Revision 1
4. EMF-91-212
5. EMF-91-208(P)
6. EMF-92-122(P)

cc: Mr. S. D. Ebneter
Mr. L. W. Garner
Ms. B. L. Mozafari

Safety Analysis for the Use of A Lead Test Assembly in HBR2 Cycle 16 in Support of a High Burnup Test and Methodology Validation Program

BACKGROUND

In Cycle 15 a reconstituted high burnup lead test assembly (LTA) was inserted into the center location of the H. B. Robinson Steam Electric Plant, Unit No. 2 (HBR2) core to begin a two cycle high burnup test program. The goals of the program are to validate Siemens Power Corporation (Siemens) design methods with respect to bundle growth, rod growth, oxide accumulation, internal pressure, and other limiting fuel assembly and fuel rod parameters at peak rod burnups exceeding the current licensed limit of 62 GWD/MTU as specified in Reference 1.

The reconstituted LTA was created by choosing a previously irradiated fuel assembly (specifically S-15, a 3.85 w/o bundle with 8 gadolinia pins of 4 w/o Gd_2O_3 and 4 gad pins of 6 w/o Gd_2O_3) as a host assembly, and replacing 128 selected fuel rods within the bundle with a combination of fresh fuel rods and high burnup donor rods from bundles S-31 and G-38 in the HBR2 spent fuel pit. The Safety Analysis addressing the use of the LTA in Cycle 15 is contained in Reference 2.

The conclusion of the 50.59 safety evaluation was that operation of the reload core with the LTA center bundle did not constitute an Unreviewed Safety Question for Cycle 15. The conclusion as it applied to the LTA was based on the results of analyses documented in Reference 2 which indicated:

1) the LTA's peak rod and bundle average exposure would remain within all licensed limits on SPC fuel analysis methodology and calculations, meaning

2) the limiting bundle mechanical parameters such as bundle cage growth, fuel rod growth, oxide accumulation, internal rod pressure, etc., and neutronic parameters such as radiological consequences would remain within the design specifications and calculated limits, and

3) the neutronic behavior of the bundle would be transparent to the Cycle 15 core relative to the assembly originally planned for the center bundle as proposed in Reference 3.

However, the 50.59 conclusion was specific to Cycle 15 operation and did not cover use of the LTA in Cycle 16 in its review scope. A 50.59 evaluation to address the use of the LTA during Cycle 16 concluded that an Unreviewed Safety Question was involved.

SAFETY ANALYSIS

In Reference 2, Siemens evaluated the behavior and end condition of the LTA after use in a realistic Cycle 16 core projected to reach 430 effective full power days (EFPD) nominal exposure. The safety analysis included evaluations which addressed mechanical, neutronic, transient, and accident behavior of the LTA for both Cycle's 15 and 16. The results of these analyses are summarized below as they apply to Cycle 16's operation with the LTA.

Neutronic Evaluation

Siemens' neutronic evaluation for operation of Cycle 16 with the LTA assumed a realistic core loading pattern, an end of cycle (EOC) 15 exposure of 400 EFPD and an EOC 16 exposure of 430 EFPD plus an additional 30 EFPD added for conservatism to cover any extended operations such as coastdowns. The results of the evaluation show the assembly will behave as a typical center bundle for both cycles 15 and 16 and will not be limiting in any key core operations or design neutronic parameters such as thermal peaking, bundle relative power, or bundle average exposure. Therefore, with any realistic cycle 16 reload design, use of the LTA would inspire no neutronic safety concerns. In addition, the actual Cycle 16 reload design development and safety analyses will be performed assuming the LTA is in the center bundle location.

However, peak rod exposures projected by the neutronic evaluation were approximately 69,000 MWD/MTU by EOC 16 - 7000 MWD/MTU beyond the licensed design analysis capabilities of Siemens methodology documented in Reference 1. Extrapolation of the Reference 1 methodology to analyses beyond peak rod burnups of 62 GWD/MTU is addressed below.

Mechanical Evaluation

Siemens mechanical evaluation consisted of performing a complete mechanical design analysis for the LTA cage, high burnup rods, and gadolina rods out to the total exposures expected by the EOC 16. Evaluation of the fresh fuel rods was unnecessary as they were designed and manufactured in accordance with, and will experience a performance and exposure history bounded by, all current Siemens design and licensed fuel specifications and limitations.

The results of the mechanical analyses indicate sufficient margins to the design limits for all mechanical attributes (fatigue, corrosion, oxide accumulation, end of life internal pressure, cladding strain, guide tube strength, etc.) save differential rod/assembly growth which is computed using an upper estimate of rod growth and a lower estimate of assembly growth. Based on this conservative calculation, and the exposure projection for the high burnup rods at EOC 16, cage/rod interference was indicated. To mitigate this possibility a special upper tie plate for the LTA cage was constructed with recesses drilled into the underside of the plate to accommodate the projected differential rod/cage growth and eliminate any possibility of interference. A prototype of the modified tie plate was then tested and found to satisfy all loading/strength requirements. The modified upper tie plate was added to the LTA during reconstitution.

As mentioned, performance of the mechanical evaluation required extension of Siemens' PWR Design Methodology of Reference 1 to peak rod burnups beyond 62 GWD/MTU. To justify/confirm the results obtained by this extension of the methodology and verify the mechanical suitability of the LTA for initial and continued irradiation, a mechanical surveillance program is in progress with the following scope:

Time		Type of Inspection
Prior to Cycle 15 operation (completed, results reported in Reference 5)	-	visual
	-	peripheral rod oxide
	-	peripheral rod diameter
	-	fuel assembly and rod growth
Cycle 15/16 Refueling Outage	-	visual
	-	fuel assembly and rod length
End of Cycle 16	-	visual
	-	fission gas
	-	fuel assembly and rod length

The purpose of the surveillance program is to monitor the LTA and identify any deviations from expected bundle mechanical behavior.

Thermal Hydraulic and Transient/Accident Evaluation

The transient and accident evaluation of Reference 2 examined the thermal hydraulic compatibility, transient and accident response, and consequences of failure of the lead high burnup rods. Because the assembly cage is the standard design with bi-metallic spacers and rod external dimensions remain unchanged, there will be no changes in the hydraulic response of the LTA due to its reconstitution, and the assembly is compatible with the co-resident fuel through Cycle 16.

In terms of transient and accident analyses, the presence of the LTA through Cycle 16 will have an insignificant impact on the core kinetics parameters that are of importance because of its more subdued neutronic behavior relative to the limiting core bundles. Thus, the LTA will have no impact on Chapter 15 events including LOCA.

In consideration of radiological consequences attributable to the LTA as the result of some accident, the projected bundle average burnup was calculated to be approximately 47,000 MWD/MTU, well within the bounding 52.5 GWD/MTU analyzed in Reference 4. As of the performance of this evaluation, Chapter 15 of the HBR2 UFSAR (and particularly section 15.7, Fuel Handling Accidents) had not been updated to reflect the results of Reference 4. However, the effort has been initiated via an appropriate 50.59 evaluation.

RESULTS

Analyses performed by Siemens in Reference 2 and the review above demonstrate that use of the reconstituted LTA through Cycle 16 is acceptable with respect to safety considerations, as behavior of the LTA's high burnup rods is steady and consistent between 62 and 69 GWD/MTU and all fuel rod design limits are preserved. This is based on results obtained from extrapolation of the Reference 1 methodology beyond its currently licensed limit of 62 GWD/MTU.

Possible rod/cage interference indicated by the mechanical analysis will be precluded by use of the aforementioned modified upper tie plate. The surveillance program will identify any unexpected or potentially limiting mechanical behavior exhibited by the bundle before its insertion into Cycle 16. These additional precautions are taken to eliminate any concerns regarding the extrapolated methodology.

CONCLUSION

Though there are no safety concerns, use of the methodology of Reference 1 for peak rod burnup exceeding 62 GWD/MTU required extrapolation beyond the NRC-approved acceptance limit for its use. This constitutes an Unreviewed Safety Question requiring NRC review.

References

1. ANF-88-133(P)(A), "Qualification of Advanced Nuclear Fuels' PWR Design Methodology for Rod Burnups of 62 GWD/MTU," December 1991, Advanced Nuclear Fuels Corporation, Richland, WA, 99352.

2. EMF-91-212(P), Supplement 1, Revision 1, "Siemens Power Corporation H. B. Robinson Unit 2, Cycle 15 With a High Burnup Lead Fuel Assembly Safety Analysis Report," July 1992, Siemens Power Corporation, Richland, WA, 99352.

3. EMF-91-212, "Siemens Nuclear Power Corporation H. B. Robinson Unit 2, Cycle 15 Safety Analysis Report," February 1992, Richland, WA, 99352.

4. EMF-91-208(P), "H. B. Robinson Unit 2 Radiological Assessment of Postulated Accidents," December 1991, Richland, WA, 99352.

5. EMF-92-122(P), "Examination and Rebuild of Siemens Power Corporation Fuel Assemblies at H. B. Robinson Unit 2, April-May 1992," Siemens Power Corporation, Richland, WA, August 1992.

ENCLOSURE 2

AFFIDAVIT

STATE OF WASHINGTON)
) ss.
COUNTY OF BENTON)

I, R. A. Copeland being duly sworn, hereby say and depose:

1. I am Manager, Product Licensing, for Siemens Power Corporation ("SPC"), and as such I am authorized to execute this Affidavit.

2. I am familiar with SPC's detailed document control system and policies which govern the protection and control of information.

3. I am familiar with the topical report EMF-92-122(P) entitled "Examination and Rebuild of Siemens Power Corporation Fuel Assemblies at H. B. Robinson Unit 2, April-May 1992," referred to as "Document." Information contained in this Document has been classified by SPC as proprietary in accordance with the control system and policies established by SPC for the control and protection of information.

4. The Document contains information of a proprietary and confidential nature and is of the type customarily held in confidence by SPC and not made available to the public. Based on my experience, I am aware that other companies regard information of the kind contained in the Document as proprietary and confidential.

5. The Document has been made available to the U.S. Nuclear Regulatory Commission in confidence, with the request that the information contained in the Document will not be disclosed or divulged.

6. The Document contains information which is vital to a competitive advantage of SPC and would be helpful to competitors of SPC when competing with SPC.

7. The information contained in the Document is considered to be proprietary by SPC because it reveals certain distinguishing aspects of SPC design methodology which secure competitive advantage to SPC for fuel design optimization and marketability, and includes information utilized by SPC in its business which affords SPC an opportunity to obtain a competitive advantage over its competitors who do not or may not know or use the information contained in the Document.

8. The disclosure of the proprietary information contained in the Document to a competitor would permit the competitor to reduce its expenditure of money and manpower and to improve its competitive position by giving it valuable insights into SPC design methodology and would result in substantial harm to the competitive position of SPC.

9. The Document contains proprietary information which is held in confidence by SPC and is not available in public sources.

10. In accordance with SPC's policies governing the protection and control of information, proprietary information contained in the Document has been made available, on a limited basis, to others outside SPC only as required and under suitable agreement providing for nondisclosure and limited use of the information.

11. SPC policy requires that proprietary information be kept in a secured file or area and distributed on a need-to-know basis.

12. Information in this Document provides insight into SPC design methodology developed by SPC. SPC has invested significant resources in developing the methodology as well as the strategy for this application. Assuming a competitor had available the same background data and incentives as SPC, the competitor might, at a minimum, develop the information for the same expenditure of manpower and money as SPC.

THAT the statements made hereinabove are, to the best of my knowledge, information, and belief, truthful and complete.

FURTHER AFFIANT SAYETH NOT.

SUBSCRIBED before me this 22
day of March, 1993.

Susan K. McCoy
NOTARY PUBLIC, STATE OF WASHINGTON
MY COMMISSION EXPIRES: 1/10/96

AFFIDAVIT

STATE OF WASHINGTON)
) ss.
COUNTY OF BENTON)

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THAT the statements made hereinabove are, to the best of my knowledge, information, and belief, truthful and complete.

FURTHER AFFIANT SAYETH NOT.

SUBSCRIBED before me this 2nd day of March 1993.

Susan K. McCoy
NOTARY PUBLIC, STATE OF WASHINGTON
MY COMMISSION EXPIRES: 1/10/96

AFFIDAVIT

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COUNTY OF BENTON)

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SUBSCRIBED before me this 2nd day of March, 1993.

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NOTARY PUBLIC, STATE OF WASHINGTON
MY COMMISSION EXPIRES: 1/10/96

ENCLOSURE 3