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SUBJECT: Submits proposed schedule for reanalysis of large break LOCA
 used to perform safety analyses for ECCS which supports
 operation at plant.

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**Carolina Power & Light Company**

Robinson Nuclear Plant
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Robinson File No: 13510

Serial: RNP-RA/97-0007

JAN 17 1997

U. S. Nuclear Regulatory Commission

Attn: Document Control Desk

Washington, DC 20555

H. B. ROBINSON STEAM ELECTRIC PLANT, UNIT NO. 2
DOCKET NO. 50-261/LICENSE NO. DPR-23
REVISED ESTIMATED EFFECT OF A SIGNIFICANT ERROR
IN AN ACCEPTABLE EMERGENCY CORE COOLING EVALUATION MODEL

Gentlemen:

In accordance with 10 CFR 50.46(a)(3)(ii), Carolina Power & Light (CP&L) Company is submitting a proposed schedule for reanalysis of the Large Break Loss of Coolant Accident (LBLOCA) used to perform safety analyses for the Emergency Core Cooling System (ECCS) which supports operation at the H. B. Robinson Steam Electric Plant (HBRSEP), Unit No. 2. The proposed schedule is to perform a reanalysis of the LBLOCA within eight (8) months of NRC acceptance of changes to the LBLOCA Evaluation Model (EM) submitted by Siemens Power Corporation (SPC) by letter dated December 20, 1996. CP&L is also submitting a revised estimated effect of a significant error in the LBLOCA which supports full power operation until the end of the current operating cycle.

By letter dated October 11, 1996, the NRC stated that certain changes incorporated in the 1991 LBLOCA EM, described in SPC topical report XN-NF-82-20, "EXEM/PWR Large Break LOCA ECCS TOODEE2 Updates," Revision 1, Supplement 5, were unacceptable. The unaccepted 1991 LBLOCA EM was intended to resolve concerns associated with the 1986 LBLOCA EM used by SPC. The 1986 LBLOCA EM was found acceptable by the NRC to meet the requirements of 10 CFR 50.46 by letter dated July 8, 1986. Changes to the 1986 LBLOCA EM have been made since NRC acceptance, and those changes have been reported to the NRC in accordance with 10 CFR 50.46(a)(3)(ii). The October 11, 1996, NRC letter also stated that the NRC will not accept LBLOCA analyses using the previously accepted 1986 LBLOCA EM unless that model adequately corrects the non-physical behavior observed in the reflood heat transfer correlation.

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By letter dated October 14, 1996, CP&L submitted notification of a significant error in the 1986 LBLOCA EM used to perform safety analyses for the ECCS which supported operation at the HBRSEP, Unit No. 2. Our letter of October 14, 1996, provided an assessment of the impact of the error in the 1986 LBLOCA EM and the actions being taken to assure compliance with 10 CFR 50.46. These actions included compensatory measures incorporated into the Core Operating Limits Report (COLR), and submitted to the NRC by letter dated October 15, 1996, for the Heat Flux Hot Channel Factor, $F_q(Z)$, reducing the allowable $F_q(Z)$ from 2.50 to 2.40 and for the Nuclear Enthalpy Rise Hot Channel Factor, $F_{\Delta H}$, reducing the allowable $F_{\Delta H}$ from 1.80 to 1.73. The estimated effect on calculated Peak Cladding Temperature (PCT) of the significant error in the 1986 LBLOCA EM, utilizing the estimate described in our letter of October 14, 1996, was an increase in PCT of 93°F to 2157°F from the previously calculated PCT of 2064°F. The estimated effect of the significant error in the 1986 LBLOCA EM supported full power operation for approximately 87 Effective Full Power Days (EFPDs) into the current operating cycle. It is projected that the plant will reach 87 EFPD on January 19, 1997.

By letter dated October 25, 1996, CP&L submitted a revision to the notification of a significant error in the 1986 LBLOCA EM, that was based upon new information provided by SPC which removed incorrectly assumed conservatism. The revised estimated effect of the significant error utilized the heat transfer coefficient correlation from FLECHT SEASET data over the entire affected range of reflood rates (i.e., 0 inches/second to 1.77 inches/second), rather than the heat transfer correlation that exhibited non-physical behavior as specified in the NRC letter dated October 11, 1996, to Mr. H. Donald Curet, SPC. The FLECHT data were taken from the references listed in our letter dated October 25, 1996. In the revised notification, the estimate of the effect of the significant error resulted in a revised increase in the calculated PCT of 64°F to 2128°F from the previously calculated PCT of 2064°F. The revised estimated effect of the significant error supported operation at a core thermal power restricted to 76% Rated Thermal Power (RTP) when using the 5% Axial Flux Deviation (AFD) band from the PDC-3 Axial Offset Control Methodology or to 78% RTP when using the 3% AFD band from the PDC-3 Axial Offset Control Methodology. The revised estimated effect of the significant error supported operation for approximately 87 EFPDs into the current operating cycle utilizing the revised COLR limits submitted to the NRC in our letter dated October 15, 1996.

In a letter dated October 25, 1996, CP&L included a plan, as required by 10 CFR 50.46(a)(3)(ii) for providing an estimate of the effect of the significant error in the LBLOCA EM that would support operation for the duration of the current operating cycle. The plan was to develop a new estimate based upon use of a Fuel Cell Test Facility (FCTF) heat transfer coefficient correlation in the 1986 LBLOCA EM that conservatively eliminated the non-physical behavior. The new correlation would limit the FCTF heat transfer coefficient to a straight line drawn between the value of the correlation corresponding to a reflood rate of

1.15 inches/second and the value of the correlation corresponding to a reflood rate of 1.77 inches/second. The straight line would extend directly along the same slope to a reflood rate of approximately 1.0 inches/second. In no case would a heat transfer coefficient value greater than that corresponding to a reflood rate of 1.77 inches/second be used. Additionally, the new estimate of the effect of the error on calculated PCT would be based upon a limitation of the core peaking factors rather than based upon a limitation in thermal power.

On October 26, 1996, in accordance with the plan, CP&L developed a new estimate of the effect of the significant error in the 1986 LBLOCA EM that supported full power operation (i.e., 100% RTP) for approximately 87 EFPDs utilizing the revised COLR limits submitted to the NRC in our letter dated October 15, 1996. The new estimate was developed based upon the FCTF heat transfer coefficient correlation described above, except that the straight line was drawn between the value of the correlation corresponding to a reflood rate of 1.0 inches/second and the value of the correlation corresponding to a reflood rate of 1.77 inches/second. The new estimate resulted in an increase in the calculated PCT of 35°F to 2163°F from the previously calculated PCT of 2128°F as reported in our letter dated October 25, 1996. Since the new estimate of the effect of the error was not a significant change (i.e., less than or equal to 50°F) with respect to the estimate reported in our letter dated October 25, 1996, this change to the estimate is required to be reported to the NRC annually in accordance with 10 CFR 50.46(a)(3)(ii) (i.e., by October 25, 1997).

In our letter dated October 25, 1996, CP&L included a plan for development of a new estimate of the effect of the error on calculated PCT based upon use of available conservatism. CP&L has completed the new estimate which results in a decrease in PCT of 14°F to 2114°F from the previously reported PCT of 2128°F. The new estimate is based upon a measured fuel pellet resintering density, corrects a previously unreported computer code error discovered during an assessment of SPC conducted by CP&L, and supports full power operation for the entire duration of the cycle at $F_q(Z)$ and $F_{\Delta H}$ limits close to the original core design. The new estimate utilizes an $F_q(Z)$ limit that increases from 2.40 to 2.49 and an $F_{\Delta H}$ limit that increases from 1.73 to 1.80. Accordingly, Revision 2 to the COLR is attached to this letter.

The new estimate utilizes a measured resinter density from a randomly selected sample from each lot of the cycle 18 reload fuel pellets as an input to the RODEX2 Fuel Rod Thermal-Mechanical Response EM¹ in place of the density change specified in the manufacture of the cycle 18 reload fuel. The manufacturing specifications for the cycle 18 reload fuel resinter density required a 95% Upper Confidence Limit (UCL) on the mean resinter density change of 1.4%. The actual measured 95% UCL resinter density change based on random samples for

¹XN-NF-81-58(P)(A) "RODEX 2, Fuel Rod Thermal-Mechanical Response Evaluation Model," SPC Nuclear Division, March 1984.

each lot was 0.87%. Therefore, previously unrealized conservatism is available by using the measured 95% UCL on the mean resinter density. The change in resinter density input to the RODEX2 EM reduces the size of the cold gap that develops early in the fuel cycle from continuation of the sintering process (i.e., resintering). Since the gap gradually closes throughout the remainder of the operating cycle due to zircaloy cladding creep, the limiting gap size for the cycle assumed in the analysis is reduced. Therefore, the stored energy in the hot fuel rod is reduced in the calculation of PCT, and consequently, the calculated PCT is reduced.

During the week of December 9-13, 1996, CP&L conducted an assessment of SPC engineering functions. During the assessment, CP&L discovered that SPC had previously identified, but not reported to CP&L, an error in the computer code for TOODEE2. The error existed in the z-equivalent model which relates the energy deposition to the subchannel at a given elevation to an equivalent energy deposition and elevation for the reflood test rod. The TOODEE2 code incorrectly used the axial shape for a FLECHT test rod as the basis, rather than the axial shape for an FCTF test rod. The error was discovered by SPC in November 1992 and an estimate of the effect of the error was performed in January 1993. This error was not accounted for in the estimated effect on calculated PCT in our notifications of October 14 and 25, 1996. The HBRSEP, Unit No. 2 core design utilizes a cosine power shape at the beginning of cycle (BOC), and the error in the z-equivalent model manifests itself in power shapes different than a cosine shape. The limiting PCT occurs for HBRSEP, Unit No. 2 in the BOC. Therefore, the error in the z-equivalent model had no effect on the estimates of PCT in our letters of October 14 and 25, 1996. The PCT impact of incorporating the correction was estimated to be limited to approximately 7°F increase in the middle of cycle case, with no impact on the limiting PCT case which is in BOC.

The proposed schedule for reanalysis, as required by 10 CFR 50.46(a)(3)(ii), is as follows. By letter dated December 20, 1996, SPC submitted to the NRC for review changes to the LBLOCA EM to eliminate the non-physical behavior. It is proposed that within eight (8) months of issuance of a Safety Evaluation Report (SER) by the NRC, the reanalysis of the HBRSEP, Unit No. 2 LBLOCA will be completed utilizing the revised approved SPC LBLOCA EM. If the new analysis should result in an estimated change in PCT greater than or equal to 50 degrees from the PCT value of 2114°F, then CP&L will make the notification required by 10 CFR 50.46(a)(3)(ii).

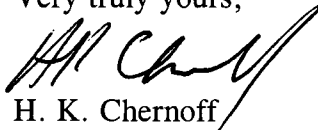
The results of this estimate have been evaluated in accordance with 10 CFR 50.59 and have been determined not to involve an unreviewed safety question.

The revised COLR was reviewed by the Plant Nuclear Safety Committee (PNSC) on January 8, 1997, as required by Technical Specifications (TS) Section 6.5.1.6.6.j. The revised COLR is being submitted in accordance with TS Section 6.9.3.3.d.

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If you have any additional questions regarding this matter, please contact me at
(803) 857-1437.

Very truly yours,



H. K. Chernoff
Supervisor - Licensing/Regulatory Programs

ALG/klb

Attachment

c: Mr. L. A. Reyes, Regional Administrator, USNRC, Region II
Ms. B. L. Mozafari, USNRC Project Manager, HBRSEP
Mr. B. B. Desai, USNRC Resident Inspector, HBRSEP