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Director
Nuclear Assessment
10 CFR 50.46(a)(3)(ii)

U. S. Nuclear Regulatory Commission
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Docket No. 50-293
License No. DPR-35

Subject: Pilgrim 10 CFR 50.46(a)(3)(ii) Report for 1999

Entergy (Pilgrim) submits this letter in accordance with 10 CFR 50.46(a)(3)(ii) which requires the reporting of changes or errors in emergency core cooling system (ECCS) analyses. For 1999 to-date, there have been no generic reports of changes or errors in the maximum limiting peak clad temperature (PCT) that apply to Pilgrim ECCS analyses as identified by General Electric Company (GE), the fuel vendor and supplier of LOCA analyses services. However, a Pilgrim-specific error was identified in a 1998 audit of Pilgrim's LOCA/ECCS calculations of record, and GE provided Entergy with an estimate of the effect of this error on Licensing Basis PCT in a letter report to Pilgrim Station.

This is the third annual report submitted by Pilgrim as required by 10CFR50.46(a)(3)(ii). The first annual report for 1997 was provided in a letter report to your office dated December 18, 1997. Prior to 1997, and since October 17, 1988, the effective date of the revision to the regulation, GE compiled all changes and errors in the approved ECCS evaluation models, as required by 10CFR50.46(3)(i) and (ii), and provided that information to the NRC annually. Enclosure 1 includes the listing of the letters sent to the NRC by GE Nuclear Energy. Enclosure 2 provides a listing of pertinent reports sent by GE and Pilgrim to the NRC, including our December 18, 1997 report. The second annual report is Reference 10 of Enclosure 2. This 1998 Report of December 17th, 1998, updated the original report.

Enclosure 1 provides a list of past correspondence provided to the NRC by GE. For each letter, a brief summary of the changes or errors, if any, and the effect, if any, of the change or error on the model(s) and predicted PCT is provided. A brief summary of the information related to Pilgrim's LOCA analyses is also provided for correspondence to and from Pilgrim in Enclosure 2. Two LER reports in 1998 were pertinent to the previous reporting period but were provided earlier in 1998 to the NRC in accordance with 30-day reporting requirements under 10CFR50.46 and 10CFR50.73. Another LER (Reference 12 of Enclosure 2) is pertinent to the current reporting period and has been provided to the NRC per the 30-day reporting requirement. These LERs are also listed in Enclosure 2. Resolution or mitigation of the major issues of these reports is summarized below.

A001

An error for a non-limiting event (loss of coolant accident [LOCA] with battery failure as single failure) was self-identified and was conservatively evaluated to increase PCT by $<70^{\circ}\text{F}$. When 70°F is added to the PCT of this event, the sum remains less than the maximum PCT reported for the limiting event (LOCA with low pressure coolant injection [LPCI] injection valve failure as single failure) in the Pilgrim FSAR Section 6.5, as referenced in NEDC-31852P, Rev 1, April 1992. A plant design change was implemented in RFO 12, May 1999. The modification resulted in a reduction of PCT by 50°F . NEDC-31852P reports the results of the most recent full-scope LOCA analysis performed for Pilgrim. The licensing basis PCT reported in NEDC-31852P is 1825°F .

Except as reported in Reference 8 (LER 98-015-00) of Enclosure 2, the cumulative increase in the licensing basis PCT in 1998 was 45°F , resulting in an estimated licensing basis PCT of 1870°F . Enclosure 3 provides the details for this conservative assessment. The increase of 10°F from our 1997 report is due to a correction of information provided in 1997 and reevaluated in 1998 for the effect of Item 8 in Enclosure 2 on Pilgrim's ECCS results. Wherever appropriate, these Enclosures include new information beyond that provided in their equivalent provided in the 1997 report. A supplement to LER 98-015-00 (Reference 8 of Enclosure 2) was issued as LER 98-015-01 (Reference 9 of Enclosure 2). The conclusion as reported in LER 98-015-01 has since been determined to be incorrect. The problem mentioned in the LER 98-015-00 and 98-0115-01 is not a concern and will be corrected by LER 98-015-02.

The predominant fuel in Cycle 13 (started in 1999) of PNPS is a 9X9 design, calculated to have the effect of decreasing Pilgrim's PCT by 10°F . This benefit was not credited in any computations supporting this report and the adjustments of any PCT value(s) in the previous two annual reports. However, the few remaining 8X8 fuel assemblies in the Pilgrim reactor are now only in low power positions, and the 10°F decrease in PCT is an applicable change to report. Excepting the effect of Item 8 in Enclosure 2, this increases the cumulative error (as a sum of absolutes) to 55°F , exceeding the 10CFR50.46 reporting criteria of 50°F .

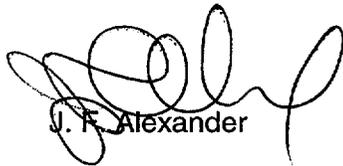
The most recently discovered error was in the GE calculation of initial coolant volume in the vessel and recirculation lines of the Pilgrim plant. During an audit, it was determined that the volume calculation omitted the free fluid volume within the recirculation pumps and the jet pumps' ram heads. Only the volume in the linear piping runs of the recirculation system and the risers were included, resulting in no credit for the time to discharge the additional coolant. In Reference 11 of Enclosure 1, GE reports a significant decrease in Licensing Basis PCT for both 8X8 and 9X9 fuels currently in the Pilgrim reactor core. Pilgrim Station has not verified this most recent report by a follow-up audit visit. After an inspection and verification of this reported calculated benefit, Entergy may then elect to accept, reject, or modify the effect of the change as part of the basis of reporting under 10CFR50.46(a)(3). However, the resolution of this is not expected to alter the conclusion of this report.

Commitments

This letter contains no commitments. While the cumulative sum of the absolutes exceeds 50°F by only 5°F, evaluation of the estimated PCT changes indicates there is no challenge to the current licensed PCT for Pilgrim. Pilgrim is currently considering an analysis in support of a potential power uprate effort and/or license extension; this is tentatively scheduled for 2004.

Should you require further information on this issue, please contact P. M. Kahler at (508) 830-7939.

Sincerely,



J. F. Alexander

- Attachments: (1) General Electric Nuclear Energy Letters Sent to NRC Relative to the Reporting of Changes and Errors in ECCS Evaluation Models
- (2) Correspondence to and from Pilgrim Relative to the Reporting of Changes and Errors in ECCS Evaluation Models
- (3) Background on ECCS Models

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ENCLOSURE 1 to ENGC 2.00.002

General Electric Nuclear Energy Letters Sent to NRC Relative to the Reporting of Changes and Errors in ECCS Evaluation Models.

1. G.E. Nuclear Energy letter to the NRC, dated June 13, 1990 (MFN 023-90); subject: Reporting of Changes and Errors in ECCS Evaluation Models.

The letter covered the period from October 17, 1988, to June 13, 1990. While this letter pre-dates the original version of NEDC-31852P by three months, analyses for Pilgrim began earlier in 1988. The letter identified three changes effecting jet pump plants which could increase or decrease PCT over a range of +20/-100°F. No specific effect within this range was identified as applying to Pilgrim.

2. G.E. Nuclear Energy letter to the NRC, dated March 12, 1991 (MFN 025-91); subject: Reporting of Changes and Errors in ECCS Evaluation Models.

The letter covered the period from June 13, 1990 to March 12, 1991. The letter identified no changes or errors in the methodology described in NEDE 23785-1-P-A, "The GESTR-LOCA and SAFER Models for Evaluation of Loss-of-Coolant Accidents," on which the Pilgrim evaluation is modeled.

3. G.E. Nuclear Energy letter to the NRC, dated June 26, 1992 (MFN 058-92); subject: Reporting of Changes and Errors in ECCS Evaluation Models.

The letter covered the period from March 12, 1991 to June 26, 1992. The letter identified no changes or errors in the methodology described in NEDE 23785-1-P-A on which the Pilgrim evaluation is modeled.

General Electric also reports that a change of input procedures in conjunction with a change in the G.E. computer operating system for SAFER/GESTR resulted in PCT changes less than +/- 50°F. Pilgrim's analyses, except for reload fuel heatup analyses, pre-dates the change in G.E.'s computer operating system. Fuel heatup analysis sets MAPLHGR limits for reload fuel that do not result in a higher PCT than previously reported for earlier fuels evaluated. Therefore, the change in PCT due to the change in GE's computer operating system and input procedures has no effect on Pilgrim's reported PCT. However, it is unlikely that the former computer operating system used for Pilgrim's LOCA analyses was retained at General Electric Company, and the revised procedural changes for input are linked to the new GE computer operating system. Hence, any future Pilgrim-specific LOCA analysis on the new GE computer operating system would be affected by this change.

4. GE Nuclear Energy letter to the NRC, dated June 30, 1993 (MFN 090-93); subject: Reporting of Changes and Errors in ECCS Evaluation Models.

The letter covered the period from June 26, 1992 to June 30, 1993. The letter identified two minor coding errors in the methodology described in NEDE 23785-1-P-A on which the Pilgrim evaluation is modeled. The errors were corrected. The impact of the errors on predicted PCT was +/- 5°F. GE also provided additional information on the impact upon PCT of the earlier reported sensitivity to changes of input procedures in conjunction with a change in GE's computer operating system. The range of impact has increased 85°F with one case of 102°F. While the letter does not specify any sign \pm for the increase in range, it can be assumed to be a positive increase in PCT. GE has not re-run Pilgrim's analysis using the new hardware.

5. G.E. Nuclear Energy letter to the NRC, dated July 1, 1994 (MFN 088-94); subject: Reporting of Changes and Errors in ECCS Evaluation Models.

The letter covered the period from June 30, 1993 to July 1, 1994. The letter identified no changes or errors in the methodology described in NEDE 23785-1-P-A on which the Pilgrim evaluation is modeled.

6. G.E. Nuclear Energy letter to the NRC, dated June 24, 1995 (MFN 087-95); subject: Reporting of Changes and Errors in ECCS Evaluation Models.

The letter covered the period from July 1, 1994 to June 24, 1995. The letter identified no changes or errors in the methodology described in NEDE 23785-1-P-A on which the Pilgrim evaluation is modeled.

7. G.E. Nuclear Energy letter to the NRC, dated December 15, 1995 (MFN 278-95); subject: Reporting of Changes and Errors in ECCS Evaluation Models.

The letter covered the period from July 1, 1994 to December 15, 1995. The letter identified no changes or errors in the methodology described in NEDE 23785-1-P-A on which the Pilgrim evaluation is modeled.

The December 15, 1995 letter contained preliminary information that was revised in a GE Nuclear Energy letter to the NRC, dated February 20, 1996 (MFN 020-96); subject: Reporting of Changes and Errors in ECCS Evaluation Models. The February 20, 1996 letter identified an additional blowdown path from the reactor vessel to the drywell when a break is postulated in a recirculation pipe line. This path is the bottom head drain line to the reactor water cleanup system (RWCU) and return to the broken recirculation line. Pilgrim does have a bottom head drain line that may result in a very small additional blowdown path from the reactor vessel. This flow pathway is also restricted by substantial long piping lengths, small piping cross sections, and other high flow resistance factors, significantly limiting the break flow rate. This was reported to be an increase of PCT of less than 10°F.

8. G.E. Nuclear Energy letter to the NRC, dated June 28, 1996 (MFN 088-96); subject: Reporting of Changes and Errors in ECCS Evaluation Models.

The letter covered the period from December 15, 1995 to June 28, 1996. There were no changes or errors in the SAFER/GESTR model described in NEDE 23785-1-P-A on which the Pilgrim evaluation is modeled. GE specifically reported to BECo in a separate letter of May 29, 1996, that the error reported for unspecified utilities having fuel with large water rods did NOT impact Pilgrim.

9. G.E. Nuclear Energy letter to the NRC, dated June 27, 1997; subject: Reporting of Changes and Errors in ECCS Evaluation Models.

The letter covered the period from June 28, 1996 to June 27, 1997. There were no changes or errors identified in the SAFER/GESTR model described in NEDE 23785-1-P-A on which the Pilgrim evaluation is modeled. GE reported a known conservatism in fuel density that would decrease PCT by 25°F.

Correspondence to and from Pilgrim Relative to the Reporting of Changes and Errors in ECCS Evaluation Models.

1. G.E. Nuclear Energy report to BECo, NEDC-32306P, "Maximum Extended Load Line Limit (MELLL) Analyses for Pilgrim Nuclear Power Station Reload 9 Cycle 10," published March 1994.

This report estimates less than a 10°F increase in PCT for initial operation at the lowest core flow rate allowed at 100% rated power for MELLL, i.e., 75% of rated core flow. However, this increase presumes equal initial fuel bundle power at 87% (previously evaluated in NEDC-31852P) and 75% (reevaluated in NEDC-32306P) rated core flow. Maximum fuel bundle power at 75% rated core flow would be less than at 87% rated core flow based upon MCPR operating limit requirements in Reference 2 listed below. This reduction in initial fuel bundle power would decrease PCT, more than offsetting the increase due to early boiling transition, the phenomenon related to lower initial core flow rate.

2. G.E. Nuclear Energy report to BECo, NEDO-31312P, "ARTS Improvement Program Analysis for Pilgrim Nuclear Power Station," published September, 1987.

This report prescribes fuel operating limits which, in conjunction with fuel specific MAPLHGR limit curves, maintains expected PCT for the postulated LOCA equal to or less than that reported in NEDC-31852P, Revision 1. These limits are updated each cycle in the Pilgrim Core Operating Limits Report (COLR) as a supplement to Technical Specifications.

3. G.E. Nuclear Energy Supplemental Reload Licensing Reports. These reports confirm to BECo that the calculated PCTs of subsequent reload fuel designs, operating under the constraints of NEDO-31312P and within fuel-specific MAPLHGR limit curves, are less than that reported in NEDC-31852P, Revision 1. Supplemental reports received after the original version of the LOCA analysis report and incorporated into the COLR, are listed below:

- "Reload 8/Cycle 9 Supplemental Reload Licensing Report," GE Report 23A7101, March 1991
- "Reload 9/Cycle 10 Supplemental Reload Licensing Report," GE Report 23A7195, March 1993
- "Reload 10/Cycle 11 Supplemental Reload Licensing Report," GE Report 24A5172, February 1995
- "Reload 11/Cycle 12 Supplemental Reload Licensing Report," GE Report J11-03014SRL, Rev 0, March 1997

4. G.E. Nuclear Energy Report GE-NE-B1100617-03, Revision 4, "Safety Evaluation of Installation of Stabilizers on the Pilgrim Nuclear Power Station Core Shroud," 1994.

Section 1.4.4 of this report assessed an increase of PCT for the limiting LOCA event to be less than 10°F for the effects of the core shroud repair implemented at Pilgrim in 1995 during RFO-10.

5. BECo letter to the NRC, dated December 18, 1997 (BEC Co Ltr. 2.97.118); subject: Pilgrim 10CFR 50.46(a)(3)(ii) Report for 1997.
6. G.E. Nuclear Energy letter to BECo, dated July 20, 1998; subject: Annual Report of Changes and Errors in ECCS Evaluation Models.

The letter covered the period from June 27, 1997 to June 30, 1998. It includes as an attachment, a related GE (G.A. Watford) letter to T.E. Collins of the NRC, dated June 30, 1998. This was a negative report; i.e., no change or error in ECCS evaluation models was identified for the period.

7. BECo letter to the NRC, dated July 22, 1998 (BEC Co Ltr. 2.98.0AA); subject; LER 98-014-00 "Degraded Voltage Restoration Time Not Consistent With FSAR".
8. BECo letter to the NRC, dated July 22, 1998 (BEC Co Ltr. 2.98.097); subject; LER 98-015-00 "Non-Conservative Degraded Voltage Setpoint".
9. BECo letter to NRC, dated November 25, 1998 (BEC Co Ltr. 2.98.147); subject: LER 98-015-01, "Non-conservative Degraded Voltage Setpoint".
10. BECo letter to NRC dated December 17, 1998 (BEC Co Ltr.2.98.157); subject: Pilgrim 10CFR50-46(a)(3)(ii) Report for 1998.
11. G.E. Nuclear Energy letter from Aaron W. Austin to S. Paranjape, BECo, dated April 22, 1999; subject: 10CFR50.46 Error Notification, AWA 99-007.
12. Entergy letter to NRC, dated August 13, 1999 (ENGC Ltr. 2.99.080); subject: LER 99-007-00, "Bus B6 Voltage Restoration Not Consistent with Safety Analysis Assumption".

ENCLOSURE 3 to ENGC 2.00.002

Background on ECCS Models

Summary

This enclosure provides a background regarding the ECCS models by which the Pilgrim LOCA evaluations were performed. Revision 1 to NEDC-31852P referenced in the Pilgrim FSAR Section 6.5.6 is the most recent report of the latest full-scope LOCA analysis of record specific to Pilgrim. This 1992 revision of the original 1990 report contained only administrative corrections to the 1990 report's results. Thus, the models used reflect those used by General Electric Company in the late 1989 to early 1990 period.

This enclosure summarizes the effects of all changes and errors on the licensing basis PCT last reported in "Pilgrim Nuclear Power Station SAFER/GESTR-LOCA Loss-of-Coolant Accident Analysis", NEDC-31852P, Revision 1, April 1992 (Reference 17, Section 6.5.6, Pilgrim UFSAR).

Background of the ECCS Evaluation Models for Pilgrim.

Before 1990, the ECCS evaluation model on which the Pilgrim evaluation was modeled consisted of the models described in General Electric Nuclear Energy document NEDE 20566-P-A, "Analytical Model for Loss-of-Coolant Analysis in Accordance with 10-CFR 50, Appendix K," January 1976, and NEDO-30767, "Pilgrim Nuclear Power Station Loss-of-Coolant Accident (LOCA) Analysis Update," September 1984. The evaluation models for the Pilgrim evaluation were changed from NEDE 20566-P-A to the models described in General Electric Nuclear Energy document NEDE 23785-1-P-A, "The GESTR-LOCA and SAFER Models for Evaluation of Loss-of-Coolant Accidents", February 1985. The change was made in 1990 to support MAPLHGR limits for fuel scheduled for cycle 9 operation. The licensing basis (Appendix K) PCT with all adders was 1825 °F for the limiting fuel type.

Summary of Effects on PCT Reported for Pilgrim in NEDC-31852P, Revision 1.

The maximum limiting PCT reported in NEDC-31852P and referenced in the Pilgrim FSAR Section 6.5.6, was 1825°F for the 4.36 square foot break of the recirculation suction line coincident with loss of offsite power and a failure of the LPCI injection valve.

Two of the three changes reported in Enclosure 2, Item 1, may apply to Pilgrim's limiting event resulting in a maximum increase of 20°F in PCT assumed for Pilgrim. However, based on the information provided, this change is as likely to result in a decrease in PCT by a maximum of 100°F. One of the two errors reported in Enclosure 1, Item 4, may apply to Pilgrim's limiting event and a 5°F increase in PCT is conservatively assumed to apply, again neglecting the possibility that the PCT may decrease by 5°F. Also, Enclosure 2, Item 4, adds 10°F to the limiting PCT and is the only reported change that specifically applies to the Pilgrim limiting event and clearly results in an increase in PCT. The maximum possible cumulative PCT is, therefore, 1870°F (1825 + 20 + 5 + 10 + 10°F).

Enclosure 1, Items 2 and 5-9, and Enclosure 2, Items 1-3 either included no changes or no errors relative to the models and methodology used to evaluate PCT for Pilgrim; or involved changes or errors that do not specifically apply to Pilgrim; or involved changes that are expected to result in a decrease in PCT. Pilgrim takes no credit for expected conservatisms until specifically incorporated into a full-scope LOCA analysis with specific assumptions and inputs applicable to Pilgrim.

The reported changes in Enclosures 1 and 2, have been reviewed. The review concludes that no combination of changes impacts non-limiting LOCA events more than that conservatively estimated for the limiting LOCA event.

A self-identified error results in an additional delay of less than 2 seconds to supply power to the LPCI injection and recirculation pump discharge valves' motors when aligned to an emergency swing bus, that is initially aligned to a diesel generator, that is subsequently assumed to be unavailable. This conservatively added $< 20^{\circ}\text{F}$ PCT to this non-limiting event, reported in NEDC-31852P as 1694°F . The sum of $1694 + 45 + 20 = 1759^{\circ}\text{F}$ remains below the maximum Appendix K licensing basis PCT of 1821°F reported in NEDC-31852P, Revision 1 as referenced in Pilgrim FSAR, Section 6.5.6.

The effects on Pilgrim PCT of input procedural changes in conjunction with computer operating system changes as reported in Enclosure 1, Items 3 and 4 have not been determined in a Pilgrim-specific LOCA analysis. The last full-scope, Pilgrim-specific LOCA analyses were evaluated before these procedure changes were implemented at GE. If evaluated in a full-scope, plant-specific LOCA analysis in early 1991 (before the GE computer system changed) using the same procedures and operating systems used in 1989-90, the effect caused by the subject items would likely be a net decrease or slight increase in the calculated PCT. An audit of GE LOCA/ECCS calculations in 1998 reinforced this expectation. In the course of evaluating the effect of 9X9 fuel on PNPS's PCT results, several computer runs for 8X8 fuel were re-executed in the 1993-4 DRF to verify consistency with 1990 results before model modifications were made for the fuel change. It was noted that the later PCT results (on the new machine) were within only a few degrees of the earlier results and no trend of either increase or decrease in PCT could be determined.