March 13, 1997

Mr. E. Thomas Boulette, Ph.D
Senior Vice President - Nuclear
Boston Edison Company
Pilgrim Nuclear Power Station
RFD #1 Rocky Hill Road
Plymouth, MA 02360

SUBJECT: REQUEST FOR ADDITIONAL INFORMATION ON THE PILGRIM NUCLEAR POWER STATION TO CREDIT CONTAINMENT OVERPRESSURE IN THE NET POSITIVE SUCTION HEAD ANALYSIS FOR THE EMERGENCY CORE COOLING PUMPS (TAC NO. M97789)

Dear Mr. Boulette:

Enclosed is a request for additional information (RAI) generated as a result of NRC staff reviews, regarding your subject submittal dated January 20, 1997. The RAI includes three enclosures representing questions from different areas of review. The staff requests that the response be provided as soon as possible as this is a restart issue.

Sincerely,

(Original Signed By)

Alan B. Wang, Project Manager
Project Directorate I-3
Division of Reactor Projects - I/II
Office of Nuclear Reactor Regulation

Docket No. 50-293

Enclosures: Request for Additional Information

cc w/encls: See next page

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NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

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Request For Additional Information

Pilgrim Credit for Containment Overpressure in NPSH Calculations

1. By letter dated January 20, 1997, Boston Edison Company (BECo) submitted a request for NRC review. The BECo letter states that "there is a question, from a licensing standpoint, whether credit for containment pressure as part of the net positive suction head (NPSH) calculation can be taken under the 10CFR50.59 process or whether NRC review is needed..... we are requesting NRC review and approval of this issue prior to March 15, 1997." Additionally, the letter requests "NRC review and approval of the wording currently in FSAR rev. 19 section 15.3.1.3." Credit for containment overpressure can be taken as part of the NPSH calculation if the credited overpressure is specified in the plant's licensing basis. The staff contends that Pilgrim's current licensing basis is that no containment overpressure is required for adequate NPSH of the emergency core cooling system (ECCS) pumps with clean strainers. With the changeout of insulation in 1984, BECo cannot assume that their ECCS strainers will be clean following a design basis loss-of-coolant accident (LOCA), therefore, Pilgrim is outside their current licensing basis. BECo should be proposing a licensing basis change in order to resolve the USQ regarding containment overpressure and debris laden ECCS strainers. Alternatively, submit information including pump manufacturers test data or other test data to demonstrate that the performance of the ECCS pumps while cavitating (i.e., with inadequate NPSH) would be adequate to fulfil their safety functions for the limiting accident conditions.

2. Page 17 of SE 2983 states that the utlimate heat sink (UHS) temperature selected for the design rating of safety related heat removal systems and equipment is 65 °F whereas the UHS temperature for the design rating of the main heat sink and associated equipment required for power generation is 75 °F. This implies that the safety related heat removal systems and equipment are not designed to perform their intended function during the warmer summer months. Furthermore, a result of the in-depth analysis of the UHS temperature indicated that the 75 °F SSW inlet temperature could be exceeded on occasion for a limited amount of time. If 75 °F is an upper-bound for the UHS, provide an explanation as to why the safety related heat removal systems are not designed for the upper-bound temperature. Also, page 2 of SE 2983 states that the 75 °F SSW injection temperature analysis will supplement rather than replace the current analysis. The staff believes that the upper-bound 75 °F temperature should replace the current 65 °F analysis. Provide justification for supplementing the current 65 °F analysis rather than replacing it.

3. Pilgrim does not have a TS limit on the UHS temperature, and thus no Limiting Condition for Operation actions need to be taken if the UHS temperature exceeds the safety related heat removal systems design rating (65 °F) or the main heat sink design rating (75 °F). Describe Pilgrim's current procedures that are in place for UHS temperatures greater than 65 °F and 75 °F. Has Pilgrim considered adopting a Technical Specification limit on UHS temperature?

ENCLOSURE 1

4. Page 20 discusses removing the reference to local pool temperature limits and the reference to the associated 160 °F bulk suppression pool temperature limit from Technical Specification Bases 3/4.7.A. However, TS Surveillance Requirements 3/4.7.A.c still references the 160 °F bulk suppression pool temperature. Will a TS amendment be requested to make the TS surveillance requirements consistent with the TS bases?

5. Page 21 of SE 2983 states that the Chapter 14 design basis LOCA analysis based on a 65 °F SSW inlet temperature assumed that at 600 seconds, one RHR pump is shutoff and the RHR loop is placed in suppression pool cooling (with or without spray). However, the design basis LOCA analysis performed using a 75 °F SSW inlet temperature assumed that at 600 seconds, LPCI with heat rejection mode, with two RHR pumps in operation is placed in service and the heat exchanger bypass valve in its full open normal position. This continues until 2 hours post LOCA when transition to LPCI with heat removal using one RHR occurs. Based on this description, the 75 °F design basis LOCA is more limiting than the 65 °F design basis LOCA. Do the Emergency Operating Procedures accommodate the differences in pump operation for the two SSW temperature cases?

6. Provide Reference 22, GE-NE-T23-00732-01, "Pilgrim Nuclear Power Station Containment Heat Removal Analysis," March 1996, (SUDDS/RF96-05, Rev.0), which performs the design basis LOCA analysis using 75 °F SSW inlet temperature.

7. Pages 26 and 27 of SE 2983 discuss the ECCS NPSH calculations for the two design basis LOCAs. FSAR Figures 14.5-10 and 13 and Figures 14.5-18 and 19 depict the NPSH availability for RHR and Core Spray pumps with leakage effects included for the 65 °F and 75 °F SSW inlet temperatures, respectively. The licensee evaluated the potential effect of insulation debris accumulating on the ECCS strainers and concluded that the increased suction head loss from the debris is within the margin for NPSH available to the ECCS pumps. The staff notes that the FSAR figures depict the licensee's calculated NPSH margin based on clean strainers. Debris on the ECCS strainers reduces the NPSH available and this fact should be depicted on the FSAR figures. Additionally, the staff notes that the margin depicted on the FSAR figures are not the licensing basis margin. Credit for the margin above atmospheric pressure entails changing the licensing basis margin.

8. Page 2 of letter dated January 20, 1997, E. T. Boulette to the NRC, states that with the maximum debris loading, a torus airspace pressure of approximately 4.1 psig is required at the peak suppression pool temperature of 178 °F to provide the required NPSH for both the RHR and CS pumps. Using Pilgrim's calculation M-662, the staff calculated that 3.6 psig is required for the 8.6 feet of head loss due to the maximum debris loading. Provide the details of the calculation for the required containment overpressure for adequate NPSH at the peak suppression pool temperature of 178 °F.

9. Upon review of the Pilgrim FSAR, the staff noted that there are two sections 14.5.3.1.3, Core Standby Cooling System Pump Net Positive Suction Head; one which begins on page 14.5-10 and one on page 14.5-11. It appears that the first section 14.5.3.1.3 was for the 65 °F salt service water case; however, the 75 °F salt service water case is discussed in the last three paragraphs of this section. The second section 14.5.3.1.3 discusses both the 65 °F and the 75 °F SSW injection temperature cases. Which section 14.5.3.1.3 is the applicable section for the design basis net positive suction head calculation? Provide an explanation as to why the 75 °F SSW injection case does not bound the 65 °F SSW case.

10. Page 14.5-12b of the FSAR, part of the second section 14.5.3.1.3, discusses NPSH available under RCIC operation. Based on the model assumptions and the NPSH required, i.e., 28 ft, this part of the FSAR is not consistent with the new 65 °F and 75 °F NPSH analyses. Was NPSH reanalyzed for these two cases under RCIC operation?

11. SE 2983 evaluates the changes to the local pool temperature limits, design basis LOCA analysis, FSAR steam line break analysis, Appendix R fire events, ATWS, station blackout, containment metal-water reaction capability, ECCS NPSH, suppression pool temperature, component cooling, building compartment cooling, environmental qualification, standby gas treatment, standby AC power sources, and piping design due to the increased SSW inlet temperature of 75 °F. According to SE 2983, new analyses were performed to verify that the increase of SSW inlet temperature is within the design basis of the affected systems. It is not clear to the staff that the increase of SSW inlet temperature is within the design basis of the affected systems and that the increase in temperature will not increase the consequences of an accident previously evaluated in the FSAR. Provide a discussion as to why the increase of service water temperature is not an unreviewed safety question.

Request for Additional Information

1. SE 2971: a) How was the suppression pool temperature profile, used to determine the containment pressure, calculated? Specify what code was used.

2. SE 2971: Why was SHEX NOT used to compute the pressure for SE 2971? Explain why you believe the ideal gas formulation for the noncondensables is adequate, versus use of a computer code. Discuss the conservatism/nonconservatism of the method you have used, as well as any other differences between the two methods.

3. SE 2971: Does SE 2971 describe the current design basis for ECCS pump NPSH? If not, what is the current design basis? In particular, does it assume 65 °F seawater temperature or 75 °F seawater temperature and strainer clogging? How much overpressure is needed? The staff needs to know explicitly the design basis regarding NPSH for the RHR and CS pumps, including the codes and assumptions used to calculate the containment pressure for NPSH purposes. State how calculation M662 ties in with SE 2971 and 2983.

4. Calculation M662: In calculation M662, initial wetwell airspace pressure is given as 0.5 psig on sheet 6 of 84, whereas it is given as 0 psig on sheet 15 of 84. Which value is actually used?

5. Calculation M662: In Table 8 of calculation M662, the wetwell free volume in the Amendment 9 column is given as 120,000 cu. ft., whereas in the more recent analyses given in the other columns it is given as 124,500 cu. ft. Why are these different?

6. Calculation M662: In Table 8 of calculation M662, in the 65 and 75 deg F columns for initial drywell relative humidity, the relative humidity is given as 80%, versus 100% in the Amendment 9 column. 80% seems less conservative from a minimum pressure perspective, since it tends to increase noncondensables in containment, resulting in a higher, not minimum, containment pressure.

   Discuss why this apparently non-conservative change was made in the relative humidity.

7. Calculation M662: In calculation M662, discuss more fully the effect of an initial drywell temperature of 150 deg F versus 135 deg F, and the rationale for choosing 150 deg F.

8. Calculation M662: In calculation M662, you assume that the steam space pressure of the containment atmosphere cancels with the vapor pressure of the suppression pool; i.e., they are both saturated. This is dependent on the mixing assumptions between the atmosphere and pool. What assumptions are made in the SHEX code (e.g., complete mixing, water falls directly to pool, etc.)?

ENCLOSURE 2

9. Calculation M662: Provide a discussion of the differences between the input parameters in the benchmark and revised analyses given in Table 4 of Calculation M662. Discuss any differences in the results, and in particular, discuss the effect of differences in input parameters on the calculated results.

10. SE 2983: What is the rationale for choosing 1.3 psig initial pressure in the drywell and 0.0 psig in the wetwell, versus assuming 0.0 psig (i.e. atmospheric) in both the drywell and wetwell? What are the normal operating conditions in the drywell and wetwell?

    Does 1.3 psig in the drywell tend to help minimize the containment pressure response, or would a lower initial pressure be more suitable for the minimum pressure calculation necessary for NPSH overpressure calculations?

11. Which GE code is used in the decay heat analyses?

12. List and justify the changes in input parameters used in the ANS 5.1 decay heat curve versus those used previously in the May-Witt analyses.

13. Provide and justify the values for the following ANS 5.1 input parameters:

    a. Q (total recoverable energy) (MeV/fission)
    b. δQ (one standard deviation of recoverable energy, Q) (MeV/fission)
    c. P (total power from fissioning of one nuclide) (MeV/sec)
    d. δP (one standard deviation of power, P, from fissioning of nuclide) (MeV/sec)
    e. Fractional fission product power for: U235, U238, Pu239 and Pu241
    f. R-factor (the actinide production multiplier)
    g. G-factor (a decay heat multiplier to account for the effect of neutron capture in fission products)
    h. Si (a multiplier applied to the G-factor equation) (fissions per initial fissile atom)
    i. Power history (length of full-power operation before shutdown)

14. Specify how the length of time at full power operation before shutdown was estimated, and confirm that this value is 3.4 years, as specified in GE Report GE-NE-T23-00732-01, "Pilgrim Nuclear Power Station Containment Heat Removal Analysis," March 1996.

15. Were the contributions to the total decay heat from U-239 and Np-239 calculated in accordance with Branch Technical Position ASB 9-2? If not, provide the equation used to calculate them, and comment on the differences between it and the models given in position ASB 9-2.

16. Justify that your use of the ANS 5.1 model for decay heat is conservative by showing that at least two standard deviations of confidence in your analyses results is provided.

Request for Additional Information

1. On page 14 of 84 of calculation M-662, there is an equation 10 which provides the maximum allowable suction line pressure loss. This equation includes a net positive suction head margin (NPSHM) term which inappropriately increases the allowable suction line loss. Also, the NPSHM term has nothing to do with possible piping obstruction degradation and increase in suction line pressure loss from the appropriate test reference value for the test flow. Should the suction line pressure loss calculation be modified?

ENCLOSURE 3