10 CFR 50.90

Boston Edison

Pilgrim Nuclear Power Station
Rocky Hill Road
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Senior Vice President – Nuclear

April 11, 1997
BECo Ltr. 2.97.042

U.S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, DC 20555

Docket No. 50-293
License No. DPR-35

Revised Request for License Amendment
to Credit Containment Pressure in ECCS NPSH LOCA Analyses

In BECo letter # 2.97.004, a license amendment for Pilgrim Nuclear Power Station was requested to allow credit for containment pressure in net positive suction head (NPSH) analyses for emergency core cooling system (ECCS) pumps. That request requires the review and approval of our new containment heat removal analysis including the 75°F seawater temperature design change. The letter also requested NRC review and approval of the license amendment in time to support Pilgrim Station restart from refueling outage #11 (RFO#11).

However, some NRC questions on the new analysis remain unresolved, and it is unlikely these questions will be resolved by the Pilgrim RFO#11 restart date. Therefore, as discussed with the NRC staff on March 31, 1997, we have evaluated NPSH using the larger ECCS pump suction strainers installed during RFO#11 and determined sufficient NPSH is available to meet pump NPSH requirements based on no containment positive pressure following a DBA-LOCA. A 10CFR50.59 safety evaluation was prepared based on this calculation. The evaluation concludes the original licensing basis assumptions are conservatively met with the larger ECCS suction strainers when limited to the original LOCA analysis based on a 65°F heat sink temperature and current design basis values for debris volume. Based on the aforementioned calculation and safety evaluation (see attachments), restart of PNPS is justified without the need for the requested license amendment.

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A001

Because the calculation and safety evaluation are based on a 65°F seawater inlet temperature, BECo commits to incorporate an administrative limit prior to restart that requires entering the loss of containment cooling limiting condition for operation (LCO) whenever seawater inlet temperature exceeds 65°F.

Also, please note the NRC deferred Pilgrim's final response to a related issue (strainer debris) in Bulletin 96-03 until the end of 1998 by NRC letter dated March 11, 1997 (Mr. Patrick D. Milano [NRC] to Mr. E. Thomas Boulette [BECo]).

In summary, this letter notifies the NRC that the requested license amendment is no longer needed to support restart. However, we still intend to resolve the remaining NRC questions so that the requested license amendment in letter #2.97.004 may be granted in time to support power operation at seawater inlet temperatures above 65°F. Generally, seawater temperatures greater than 65°F occur sporadically at Pilgrim Station during the summer months.

If you have any questions regarding this letter, please contact Mr. Jeffrey Keene at (508)830-7876 or P. M. Kahler at (508) 830-7939.

E T Boulette

E. T. Boulette, PhD

ETB/PMK/avf/npsh2

Attachments: 1) Pilgrim Safety Evaluation #3088
2) Pilgrim Calculation M-734

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Pilgrim Nuclear Power Station

ATTACHMENT 1 TO BECO LTR. 2.97.042

PILGRIM SAFETY EVALUATION # 3088

FRN 96-16-06
P 6 OF 20

Safety Evaluation
No. 3088
RTYPE A9.03

SAFETY EVALUATION
PILGRIM NUCLEAR POWER STATION

Initiator	Dept.	Division	Document No.	Calc. No.	System Name
P.D. Harizi	NESG	Mech. Eng.		Calc M-734	RHR Core Spray

Description of Proposed change, test, or experiment: Interim evaluation of ECCS Pump NPSH with new stacked disk suction strainers using original FSAR design basis LOCA analysis with a 65°F heat sink.

SAFETY EVALUATION CONCLUSIONS:

	Yes	No	
1.	☐	☒	May the proposed activity increase the probability of occurrence of an accident previously evaluated in the Final Safety Analysis Report?
2.	☐	☒	May the proposed activity increase the consequences of an accident previously evaluated in the Final Safety Analysis Report?
3.	☐	☒	May the proposed activity increase the probability of occurrence of a malfunction of equipment important to safety previously evaluated in the Final Safety Analysis Report?
4.	☐	☒	May the proposed activity increase the consequences of a malfunction of equipment important to safety previously evaluated in the Final Safety Analysis Report?
5.	☐	☒	May the proposed activity create the possibility of an accident of a different type than any previously evaluated in the Final Safety Analysis Report?
6.	☐	☒	May the proposed activity create the possibility of a different type of malfunction of equipment important to safety than any previously evaluated in the Final Safety Analysis Report?
7.	☐	☒	Does the proposed activity reduce the margin of safety as defined in the basis for any Technical Specification?

BASIS FOR SAFETY EVALUATION CONCLUSIONS:

This interim evaluation demonstrates that the original licensing basis assumptions are conservatively met with the new ECCS suction strainers when limited to the original LOCA analysis based on a 65°F heat sink temperature and current design basis values for debris loading. See Attachment 1.

Safety Evaluation Performed by P.D. Harizi P.D. HARIZI Date 04-08-97

FRN 96-16-05
P 7 OF 20

Safety Evaluation
No. 3088

SAFETY EVALUATION
PILGRIM NUCLEAR POWER STATION

A. APPROVAL

Comments: None

Thomas White Jr 4/8/97
Discipline Division Mgr./Date

NA
Supporting Discipline Division Mgr./Date

B. REVIEW/APPROVAL

☐ Comments:

Jeffrey Rogan 4/8/97
S&SA Division Mgr./ Date

NOTES:
1) Items (14) and (15) are not required for Safety Evaluation prepared by the Plant Department.
2) The independent technical review of Plant Department Safety Evaluations is documented in Item C below.

C. ORC REVIEW

☐ This proposed change involves an unreviewed safety question and a request for authorization of this change must be filed with the NRC prior to implementation.

☑ This proposed change does not involve an unreviewed safety question.

ORC Chairperson JA Levy Date 4/10/97

ORC Meeting Number 97-56

cc:

FRN 96-16-06
P 8 OF 20

Safety Evaluation No. 3088

D. FSAR Review Sheet

List FSAR text, diagrams, and indices affected by this change and corresponding FSAR revision.

Affected FSAR Section

Preliminary revision to the affected FSAR Section is shown on:

NONE

NOTE:

This SE provides an interim evaluation based on limiting conditions. The assumptions used are conservatively bounded by the current FSAR. The FSAR will be appropriately updated as part of the final response to NRC Bulletin 96-03 and/or as part of an updated accident analysis for higher heat sink temperatures.

PRELIMINARY FSAR REVISION (to be completed at time of Safety Evaluation preparation).

Prepared by: P. D. Hanzi Date: 04-08-97

Approved by: Thomas Whitely Date: 4/8/97

FINAL FSAR REVISION - Prepared in accordance with NOP83E4 following operational turnover of related systems, structures, or components for use at PNPS.

FRN 96-16-06
P 7 OF 20

Safety Evaluation No. 3088

E. SAFETY EVALUATION WORK SHEET

A. System/Component Failure and Consequence Analyses.

	System/Component	Failure Modes	Effects of Failure	Comments
1	RHR and Core Spray	LOCA pipe break jet impingement destroys insulation and transports debris into torus.	Debris accumulation on torus suction strainers for RHR and Core Spray pumps increases suction head losses.	Effect of debris was evaluated and the increased suction head loss is within the margin for NPSH available to the ECCS pumps. See Attachments.
2				
3				

General Reference Material Review

FSAR SECTION	PNPS TECH. SPECS	CALCULATIONS DESIGN SPECS. PROC.	REGULATORY GUIDES STANDARDS CODES
4.8.5.1	Section 3.2.H	Calculation M-734 Rev. 0	Reg. Guide 1.82 Rev. 1
6.4.3	Section 3.5.A & B	Calculation M-662 Rev. E2	NRC Bulletin 96-03
14.5	Section 3.7.A	GE Report GE-NE-B13-01805-11	
	Section 4.7.A.2		

B. For the proposed hardware change, identify the failure modes that are likely for the components consistent with FSAR assumptions. For each failure mode, show the consequences to the system, structures, or related components. Especially show how the failure(s) affects the assigned safety basis (FSAR text for each system) or plant safety functions (FSAR Chapter 14 and Appendix G.)

Prepared by P.D. Harizi P.D. HARIZI Date 04-08-97

Safety Evaluation - Attachment 1

A. Description of Change

This Safety Evaluation provides an interim analysis of RHR and Core Spray pump Net Positive Suction Head (NPSH) conditions following a Design Basis Loss of Coolant Accident (DBA-LOCA). This interim evaluation is based on the current design basis analysis for LOCA-generated debris, new RHR and Core Spray pump suction strainers, and the original FSAR DBA-LOCA analysis with a 65°F heat sink.

B. Purpose of the Change

Replacement of the original drywell piping insulation in 1984 and the potential effect on ECCS pump NPSH was evaluated in SE-2971 [Ref. 1]. In RFO-11, the RHR and Core Spray pump suction strainers were replaced with large capacity stacked disk strainers as part of the response to NRC Bulletin 96-03 [Ref. 2]. To support the Pilgrim restart from RFO-11, it is necessary to produce this interim Safety Evaluation that is based on the new strainer debris capacity and the original FSAR DBA-LOCA analysis based on a 65°F heat sink temperature. The postulated LOCA-generated debris is the current Pilgrim design basis value from an analysis performed in accordance with Regulatory Guide 1.82 Rev. 1 [Ref. 3]. With these conditions, it is demonstrated that there is adequate NPSH margin to accommodate the postulated debris without affecting pump performance using an NPSH margin that is very conservatively based on zero containment positive pressure following a DBA-LOCA. This evaluation will remain applicable until the Pilgrim design basis analysis is upgraded in accordance with Regulatory Guide 1.82 Rev. 2 as part of the final resolution for NRC Bulletin 96-03 and/or is superseded by an updated accident analysis for higher heat sink temperatures.

C. Systems, Subsystems, Components Affected

1. Directly Affected:

   Residual Heat Removal (RHR) System
   Core Spray System

2. Indirectly Affected:

   Reactor Building Closed Cooling Water (RBCCW) System
   Salt Service Water (SSW) System

3. List drawings, FSAR, Tech. Spec., other documents:

   The following documents are referred to by [Ref. #] in this SE:

[1] SE-2971 "Replace all piping thermal insulation in the drywell with Owens-Corning NUKON fiberglass blanket insulation", 25-MAR-96.

[2] NRC Bulletin 96-03 "Potential Plugging of Emergency Core Cooling Suction Strainers by Debris in Boiling-Water Reactors".

[3] Regulatory Guide 1.82 Rev. 1, "Water Sources for Long-Term Recirculation Cooling Following a Loss-of-Coolant Accident", U.S. Nuclear Regulatory Commission, November, 1985.

[4] BECo Calculation M-662 Rev. E2 "RHR and Core Spray Pump NPSH and Suction Pressure Drop".

[5] BECo Calculation M-734 Rev. 0 "RHR and Core Spray Pump Suction Strainer Debris Head Loss NPSH Evaluation".

[6] GE Report GE-NE-B13-01805-11 "Effects of Fiberglass Insulation Debris on Pilgrim ECCS Pump Performance" January 1996, SUDDS/RF # 96-02.

[7] FSAR Section 14.5.3 "Loss of Coolant Accident".

D. Functions of Affected Systems/Components

The Residual Heat Removal (RHR) and Core Spray (CS) Pumps are part of the Core Standby Cooling Systems (CSCS)(FSAR Section 6). The RHR Pumps provide low pressure coolant injection (LPCI) to the reactor after depressurization either due to a Loss of Coolant Accident (LOCA) or by operation of the Automatic Depressurization System (ADS). The RHR Pumps also provide for decay heat removal in the Suppression Pool Cooling and Containment Spray modes of operation (FSAR Section 4.8). The CS Pumps provide low pressure core spray (LPCS) flow to the vessel in a continuous recirculation mode from the suppression pool. Both the LPCI and LPCS are required to mitigate the consequences of the various postulated LOCA and Steam Line Break (SLB) accidents by providing emergency core cooling and containment cooling via the RHR operating modes.

E. Effect on Functions

As a consequence of a LOCA or SLB, the NUKON insulation in the vicinity of the break may be damaged or destroyed by the jet impingement forces. The fiberglass debris generated by the line break may then be transported from the drywell into the suppression pool. Insulation shreds and fibers in various forms may continue to transport through the suppression pool water and ultimately some portion may accumulate on the suction strainers of the operating ECCS pumps. The accumulated debris on the strainers would increase the head loss of the strainer and thereby decrease the Net Positive Suction Head (NPSH) available to the ECCS pumps. If a sufficient amount of debris accumulates on the strainer, the margin for NPSH available to the pump may be exceeded resulting in cavitation, reduced performance, and potential damage to the pump.

F. Analysis of Effect on Functions

The effect of LOCA-generated debris on the NPSH available to the RHR and Core Spray pumps is evaluated in Calculation M-734 [Ref. 5]. The assumptions used in this interim evaluation are based on the current design basis analysis for LOCA-generated debris, new suction strainer debris capacity, and the original FSAR DBA-LOCA analysis with a 65°F heat sink as described above in Section B.

The calculated total volume of LOCA-generated debris from [Ref. 6] is 23 ft^3. Applying the entire volume to one suction strainer with 2 RHR and 1 Core Spray pump operating at maximum flow, the head loss due solely to the debris is less than 0.01 ft. The minimum available margin for LOCA debris for the limiting Core Spray pump is greater than 2 feet based on only the containment pressure available prior to the accident (0.5 psig) and is equal to 0.9 feet assuming zero positive pressure following a DBA-LOCA [Ref. 4]. Therefore, there is adequate NPSH margin to accommodate the postulated debris loading without affecting pump performance.

The total margin for NPSH available as described in FSAR Section 14.5.3.1.3 greatly exceeds the value of 2 feet at the peak suppression pool temperature when the equilibrium pressure in containment is included in the NPSH calculation. This SE and Calculation M-734 [Ref. 5] do not include the contribution to the available NPSH margin from the equilibrium conditions that exist for the containment atmosphere. The FSAR method for evaluating NPSH is consistent with the original design basis calculations for NPSH margin as described in SE-2971 [Ref. 1]. Therefore, for this interim evaluation, the limiting assumptions used are conservatively bounded by the original design basis and the FSAR.

G. Summary

Since this evaluation is based on a DBA-LOCA analysis that is from the original FSAR, together with an evaluation of LOCA-generated debris that comprises the current design basis, and NPSH margin is very conservatively based on zero containment positive pressure following a DBA-LOCA, there is no unreviewed safety question involved for plant operation that remains within the defined limits of a 65°F heat sink.

1. Q: May the proposed activity increase the probability of occurrence of an accident previously evaluated in the Final Safety Analysis Report?

   A: No, there are no new accident initiators or changes to the existing assumptions for the probability of any event considered in the FSAR.

2. Q: May the proposed activity increase the consequences of an accident previously evaluated in the Final Safety Analysis Report?

   A: No, there is no change to the consequences for postulated accidents since there is no change to the assumed RHR and Core Spray pump performance.

3. Q: May the proposed activity increase the probability of occurrence of a malfunction of equipment important to safety previously evaluated in the Final Safety Analysis Report?

   A: No, there is adequate NPSH margin to accommodate the postulated debris without affecting pump performance.

4. Q: May the proposed activity increase the consequences of a malfunction of equipment important to safety previously evaluated in the Final Safety Analysis Report?

   A: No, there is no change in the equipment failure assumptions for the accident analysis.

5. Q: May the proposed activity create the possibility of an accident of a different type than any previously evaluated in the Final Safety Analysis Report?

   A: No, there is no changes or effect upon the events considered in the FSAR accident analyses.

6. Q: May the proposed activity create the possibility of a different type of malfunction of equipment important to safety than any previously evaluated in the Final Safety Analysis Report?

   A: No, there is no change in the way that equipment failures are considered for accident analyses.

7. Q: Does the proposed activity reduce the margin of safety as defined in the basis for any Technical Specification?

   A: No, the potential effect from insulation debris accumulating on ECCS pump suction strainers has been evaluated [Ref. 5]. The conclusion is that the increase in suction head loss from the postulated debris accumulation is within the margin for NPSH available to the ECCS pumps. Since the NPSH available at the pump suction exceeds the NPSH required, the pump will achieve its rated performance. Therefore, there is no effect on ECCS pump performance and no change in the margin of safety as determined by the accident analyses. The bases for the Technical Specification requirements regarding Core Spray, LPCI, and Containment Cooling (Sections 3.5.A & B) do not prescribe NPSH criteria per se but it is an implicit assumption for the pump performance criteria that adequate NPSH be provided. There is no requirement that a specific amount of excess NPSH margin be available after all postulated degradations have been included in the analysis. Furthermore, [Ref. 3] explicitly defines a design as adequate when $NPSH_A$ is simply greater than $NPSH_R$ (corrected for air ingestion when appropriate).