Boston Edison
A BEC ENERGY COMPANY

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and Station Director

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BECo Ltr. 2.99.001

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, D.C. 20555-0001

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

REQUEST FOR LICENSE CHANGE
CONCERNING ECCS NPSH

Purpose

Boston Edison Company (Pilgrim Nuclear Power Station) requests NRC review and approval for the use of new values for post-accident containment pressure in Pilgrim's net positive suction head (NPSH) analyses performed for the emergency core cooling system (ECCS) pumps. The new values are required to accommodate the postulated pump suction strainer head loss due to loss-of-coolant accident (LOCA) generated debris conservatively calculated in accordance with NRC Bulletin 96-03 and Regulatory Guide 1.82, Revision 2. The new strainer head loss values are higher than previous analytical values and are considered to be bounding for all postulated events or accidents. The attached "No Significant Hazards Considerations" evaluation is provided to assist the NRC in its review.

Background

On January 20, 1997, Pilgrim requested the NRC to review and approve credit for post-accident containment pressure in Pilgrim's NPSH analyses performed for the emergency core cooling system pumps. The request was supplemented with additional information on January 30, February 27, April 11, May 14, and June 20, 1997. On July 3, 1997, the NRC issued License Amendment 173 and its associated Safety Evaluation Report (SER). The SER described the bases for allowing the use of particular amounts of containment pressure in NPSH analyses. At the time of these NPSH evaluations, the suction strainer debris head loss was based on earlier analyses using Regulatory Guide 1.82, Revision 1. As stated in the SER, the strainer debris analysis was expected to be reevaluated pursuant to NRC Bulletin 96-03. The debris analysis performed in accordance with NRC Bulletin 96-03 and Regulatory Guide 1.82, Revision 2, resulted in an increase in strainer estimated debris loading and head loss, but the head loss remained within the total NPSH margin available to the residual heat removal (RHR) and core spray (CS) pumps. The method for calculating NPSH available and NPSH margin are the same as those reviewed for the Amendment 173 SER. The total available NPSH margin has

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not been changed from that determined in accordance with Amendment 173. Only the method of estimating strainer debris loading calculating strainer debris head loss has been updated. The containment pressure limits approved for NPSH analysis in Amendment 173 are not sufficient to accommodate the new debris head loss. The attached information and "No Significant Hazards Considerations" are provided to demonstrate that higher containment pressure values are justified for use in Pilgrim's NPSH analyses.

Please contact P.M. Kahler if you should require further information on this issue.

T A Sullivan

T. A. Sullivan

Commonwealth of Massachusetts)
County of Plymouth)

Then personally appeared before me, T. A. Sullivan, who being duly sworn, did state that he is Vice President Nuclear, Station Director of Boston Edison Company and that he is duly authorized to execute and file the submittal contained herein in the name and on behalf of Boston Edison Company and that the statements are true to the best of his knowledge and belief.

My commission expires: September 20, 2002 Peter M Kahler
DATE NOTARY PUBLIC

Attachments

1) Updated NPSH Evaluations for RHR and Core Spray Pumps.
2) Proposed "Updated Final Safety Analysis Report" changes.
3) Determination of No Significant Hazards Considerations.
4) Bulletin 96-03 Submittal, Pilgrim Station

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ATTACHMENT 1 TO BECO LETTER 2.99.001

Updated NPSH Evaluation for RHR and Core Spray Pumps

The NPSH analyses referenced by this submittal were performed using a methodology that has been previously reviewed by the NRC as part of License Amendment 173 (TAC No. M97789). The July 3, 1997, Safety Evaluation Report (SER) related to Amendment 173 describes the results from a review of BECo Calculation M-662, which is the Pilgrim design basis calculation for available NPSH to the RHR and core spray pumps. The thermal equilibrium method used in Calculation M-662 for calculating containment pressure and NPSH available is consistent with the original Pilgrim FSAR and has not been changed for this submittal. The current Calculation M-662, Revision E3 (attached) was updated to be based on the new suppression pool temperature profile from the containment analysis using two-sigma decay heat per the requirements of Amendment 173. BECo Calculation M-734, Revision 2, (attached) evaluated the effect of the new suction strainer debris head loss on RHR and core spray pump NPSH. This calculation was updated to include the new debris head loss described in this submittal.

The RHR and core spray pumps are not degraded by the postulated suction strainer debris head loss since there is adequate NPSH margin available to accommodate the head loss without causing pump cavitation when the calculated containment pressure is used for the NPSH analysis. The new debris head loss nonetheless constitutes a nonconforming condition because the allowable containment pressure that may be assumed for NPSH analysis per FSAR Section 14.5.3.1.3 does not provide sufficient NPSH margin. These FSAR containment pressure limits that were approved by Amendment 173 are not sufficient to accommodate the updated debris head loss. The basis for the previous limits was an earlier debris analysis that postulated a lower strainer head loss and, consequently, a lesser amount of containment pressure was required. Although it is shown there is sufficient NPSH margin to accommodate the updated debris head loss, the FSAR currently limits the amount of pressure that may be considered. This licensing submittal requests NRC review of the updated debris analysis and containment pressure requirements.

It is proposed the containment pressure that may be assumed in pump NPSH and suction strainer evaluations be limited in the FSAR to the following pressure profile:

Time After Accident (sec)	Time After Accident (hour)	Containment Pressure (psig)	Containment Pressure (psia)
0 to 1,200	0.00 to 0.33	0.0	14.7
1,200 to 1,800	0.33 to 0.50	1.9	16.6
1,800 to 3,600	0.50 to 1.0	3.0	17.7
3,600 to 57,600	1.0 to 16.0	5.0	19.7
57,600 to 108,000	16.0 to 30.0	2.5	17.2
108,000 to 172,800	30.0 to 48.0	1.0	15.7
172,800 to 864,000	48.0 to 240.0	0.0	14.7

This containment pressure profile is completely enveloped by the containment pressure calculated using the conservative equilibrium method to determine the available NPSH. Containment pressure within these limits provides sufficient NPSH margin to accommodate the suction strainer debris head loss for the RHR and core spray pumps following a DBA-LOCA.

The first time step for which positive containment pressure (overpressure) is assumed is at 1200 seconds. This ensures the RHR pumps in the LPCI mode and a core spray pump can perform the initial recovery of core cooling without requiring any amount of containment pressurization during the initial 1200 seconds for the bounding DBA-LOCA. This is consistent with the analysis reviewed for Amendment 173.

The design basis loss-of-coolant-accident (DBA-LOCA) is the reactor recirculation system line break, which results in the most rapid heatup of the suppression pool to its highest peak temperature. The DBA-LOCA case provides a bounding analysis with respect to NPSH. The containment heatup analysis that produces the suppression pool temperature profile was performed using the GE computer code SHEX for primary containment thermodynamic analysis. The containment modeling and assumptions were set to maximize the pool temperature. The DBA-LOCA pool profile is based on a single loop of containment heat removal, the highest ultimate heat sink temperature (75°F), ANSI/ANS 5.1 two-sigma decay heat, and initial conditions for power level, operating history, containment conditions, flow rates, and heat exchanger performance that maximize pool temperature.

The results from the DBA-LOCA NPSH analysis are illustrated in attached Figures 1 and 2. Figure 1 shows the containment pressure available and the pressure required to provide adequate NPSH to the RHR and core spray pumps with a clean strainer and with the new debris head loss included. The new proposed FSAR containment pressure limits are also shown on Figure 1. The core spray pumps are more limiting for NPSH than the RHR pumps. Figure 2 shows, in units of feet, the corresponding total NPSH margin available with a clean strainer, the postulated debris head loss, and the margin available for the most limiting ECCS pump based on the proposed FSAR containment pressure limits. The total NPSH margin depicted in the figures is based on the conservative lower bounding containment pressure existing due to thermal equilibrium principles for an enclosed volume (primary containment) as described in FSAR Section 14.5.3.1.3.

As illustrated in Figures 1 and 2, the proposed FSAR containment pressure limits provide sufficient NPSH margin to accommodate the new debris head loss. The proposed FSAR limits are less than the available containment pressure determined using the thermal equilibrium method. These NPSH calculations are based on the suppression pool temperature profile for the DBA-LOCA with a 75°F SSW heat sink, which has a peak pool temperature of 182.3°F. In addition, NPSH was evaluated at the design peak suppression pool temperature of 185°F and the 5.0 psig proposed limit provides sufficient margin for the RHR and core spray pumps with the DBA-LOCA debris head loss at that point in time.

It is also shown on Figure 2 that the FSAR limits will not, at all points in time, provide the additional two feet of NPSH margin that is allocated to pump inservice testing (IST) as described in Calculation M-662. The additional two feet of NPSH margin is provided at the peak pool temperature for the bounding DBA-LOCA and at most other points. There is a two foot or greater NPSH margin between the debris head loss profile and the margin provided by the containment pressure as determined in Calculation M-662 using the FSAR thermal equilibrium method up to and through the peak pool temperature and at all times during the first 48 hours after a DBA-LOCA. The 48 hour period of time is significant because containment positive pressure (overpressure) is credited for providing sufficient NPSH up to 48 hours. The NPSH margin based on the proposed FSAR pressure limits is intended to envelop the bounding DBA-LOCA strainer debris head loss. The two foot head loss allocated to IST represents additional margin provided to account for uncertainty and it is considered sufficient to demonstrate that this unused margin exists during the period of time that containment pressure greater than atmospheric is credited.

As indicated below, the suction strainer head loss caused by debris is less than or equal to the available NPSH margin provided by the proposed FSAR pressure limits. Also, during the period of time in the accident response that any pressure greater than atmospheric is credited (i.e., 48 hours), the available margin based on the equilibrium method is at least two feet more than the available margin provided by the proposed FSAR pressure limits.

Debris Head Loss	≤	*FSAR Pressure Limit NPSH Margin*	≤	*FSAR Equilibrium Method NPSH Margin 2 ft Above Debris First 48 Hours*

The DBA-LOCA includes an immediate blowdown of the reactor vessel to primary containment resulting in the most rapid initial heatup of the suppression pool to approximately 130°F. The subsequent transfer of heat from the reactor core to the pool is also maximized by the continuous core flooding provided by the operation of one core spray and two RHR pumps at maximum flow for the first two hours. In addition, the DBA-LOCA provides the maximum generation, transport, and accumulation of debris on the suction strainer. The assumption of three ECCS pumps operating for two hours on a common suction strainer provides the maximum debris accumulation and head loss on the strainer; that is, the accumulation of debris from the pool is essentially maximized at the two hour point and no further debris is present to accumulate on the strainer. At this point, it is assumed that one RHR pump is shut off and a mode of LPCI with Heat Rejection with one RHR pump begins and is maintained for the duration of the recovery. As shown on Figure 2, the debris head loss drops from the peak of 11.5 feet to 6.2 feet at the two hour cutoff of the second RHR pump due to the decrease in the total flow through the common strainer. The debris head loss remains less than 6.4 feet until the peak pool temperature has passed and the long term cooldown begins. The steady increase in debris head loss that begins after 8 hours is due solely to the effect of viscosity increasing as the pool temperature drops.

At approximately 72 hours (3 days) after the DBA-LOCA, the containment equilibrium pressure decreases to atmospheric pressure and the NPSH margin is at its minimum point for the entire event. The pool temperature is 132°F at the point of minimum NPSH margin and atmospheric pressure. At the minimum point, there is 10.1 feet of total available NPSH margin and 8.8 feet of debris head loss. From the minimum point onward, the NPSH margin and debris head loss increase in equal proportion such that sufficient NPSH remains out to the final 240 hour (10 day) point at which the pool temperature is 112°F. Based on the data up to the 240 hour point, this trend will continue as the pool cools down to lower temperatures. After the 72 hour minimum margin point, the containment remains at atmospheric pressure and it is shown that there is sufficient NPSH for all temperatures below 132°F at atmospheric pressure (i.e., without overpressure). The analysis does not assume any favorable change in conditions has occurred. However, it is reasonable to assume additional water will have been added to the suppression pool before 72 hours. Each foot of additional water level adds one foot to the NPSH margin, plus the water added from an external source is expected to be cooler and will lower the bulk suppression pool temperature. In addition, the other RHR loop may be restored to service and/or better heat removal achieved due to better pump or heat exchanger performance or lower heat sink temperature.

Calculation M-662 determined the minimum NPSH available (NPSHA) to the RHR and core spray pumps for the bounding DBA-LOCA. The equilibrium method produced more limiting results than a complex computerized analysis that used detailed models of the heat transfer mechanisms in primary containment. The DBA-LOCA and steam line break accidents were evaluated for NPSH using a computerized model of primary containment done with the GE computer code SHEX. The steam line break NPSH analysis was part of the updated containment heatup analysis using two-sigma decay heat per Amendment 173. The effects from containment leakage and passive heat sinks in the drywell, wetwell, and suppression pool are incorporated into the SHEX model for NPSH evaluations. The mechanistic analysis for the steam line break cases was done using containment spray as the means of transferring heat from the steam atmosphere to the suppression pool with only makeup water added to the reactor vessel by a core spray pump. For the steam line breaks, the reactor core continuously produces steam that pressurizes the containment and the containment spray flow from the RHR pump is required to transfer heat to the suppression pool. During the long-term recirculation period for the DBA-LOCA, the water exiting the reactor vessel is always subcooled (no steam production) since the vessel is continuously flooded by both the core spray and RHR pumps. Transfer of heat by subcooled liquid at relatively high flow rates, as compared to steam line break events, flushes the heat energy from the primary system and results in a higher pool temperature at lower containment pressure.

The DBA-LOCA analysis is based on maximizing suppression pool temperature while the containment atmosphere is assumed to be in thermal equilibrium with the pool. This provides the most limiting case for NPSH analysis when conservative assumptions are used for the operation of the ECCS pumps. If the assumptions are changed to maximize cooling, lower the heat sink temperature, and/or minimize decay heat, this analysis remains controlling for NPSH. Lower suppression pool temperatures are preferable and constitute a less challenging condition for accident recovery. However, there are operational considerations that may arise at lower pool temperatures. If one core spray and two RHR pumps are allowed to operate up to the two hour point at water temperatures lower than the 176.8°F given in Table 2, the peak debris head loss will be higher than 11.5 feet due solely to the increase in viscosity. As given in Calculation M-662, at 130°F with atmospheric pressure in containment (i.e., no overpressure), there is 10.3 feet of NPSH margin for the limiting core spray pump. The debris head loss may exceed 10.3 feet with 3 ECCS core spray pumps running at low water temperatures. However, by shutting down one RHR pump, the head loss decreases as shown on Figure 2 at the two hour point. At pool temperatures of 130°F and below, Figures 1 and 2 show there is sufficient NPSH assuming only atmospheric pressure in containment with one

RHR and core spray pump operating. Therefore, containment pressurization is only a necessary consideration for pump NPSH when the suppression pool is above 130°F.

The most limiting case DBA-LOCA analysis assumes that the second RHR pump is shut down after the first two hours. As shown on Figure 1, the curve for containment pressure required with debris meets the 5.0 psig limit at this point in time. It is not necessary to assume more than the proposed 5.0 psig limit since shutting down the second RHR pump will mitigate any cavitation that occurs due to the maximized flow rate.

The operating scenario for the RHR and core spray pumps following a DBA-LOCA is conservative for NPSH analysis. The pumps are assumed to be at maximum flow for the entire duration of long term cooling, (i.e., no throttling of control valves is performed). The RHR loop is assumed to operate in the two-pump LPCI mode for the first two hours. The two hour time period is considered to be a bounding maximum for operators to change to the single pump LPCI mode in order to maximize containment heat removal. DBA-LOCA analysis involves the creation of a worst-case scenario with corresponding operator actions based on the symptoms and indications that will be observed, together with the procedures that will be used. It is expected this RHR pump transition will be performed earlier than at two hours, which is more favorable for both debris accumulation and suppression pool temperature. The two hour point is also conservative because it is approximately the amount of time needed to accumulate all the available debris in the suppression pool onto the strainer. Therefore, should the two-pump LPCI mode be continued for longer than two hours there would not be a significant increase in the debris head loss above the value at the two hour point until the pool begins to cool down after six hours have passed. Furthermore, upon shutting down the second RHR pump beyond two hours the resulting debris head loss would not be significantly greater than given on Figure 2 for the same point in time.

Cavitation temporarily decreases pump performance immediately upon its inception, due to the vapor formation within the impeller inlet that displaces the more dense liquid thereby decreasing the flow rate. At the higher pressures existing at the impeller periphery, the vapor condenses rapidly with a resulting impact or shock wave effect on the pump internals. There is a legitimate concern with damage occurring with a cavitating pump but the level of concern varies with the type of pump and the length of operation with cavitation. The Pilgrim RHR and core spray pumps are of a rugged single stage design with stainless steel internals. This pump design and the materials of construction are highly tolerant to cavitation. Short term operation in a cavitating regime will not damage these pumps.

The FSAR analysis method does not require that containment pressure be greater than the minimum value that is inherently established by the containment being an enclosed airspace in thermal equilibrium with the suppression pool. These assumptions are applicable for the DBA-LOCA and all other events and transients that do not include the use of containment spray for containment cooling. The use of containment sprays, when appropriate for steam line breaks, has been evaluated mechanistically, as described above, and shown to be less limiting for NPSH analysis than the DBA-LOCA. Other reactor shutdown and isolation events produce less debris, lower pool temperatures, and utilize single RHR pump operation in torus cooling rather than the LPCI with heat rejection mode.

There are potential sets of conditions that, although they are more favorable than the severe conditions of the DBA-LOCA, may require that containment spray be controlled in response to operator observations. A small steam line break with maximized cooling and a low temperature heat sink can result in the containment atmosphere being reduced to a temperature below that of the suppression pool by the continuous use of containment spray. Under these conditions, the available NPSH margin will be reduced below the equilibrium value for the given pool temperature. However, if pump cavitation should occur, operators will recognize the condition using instruments available in the main control room and stop the use of spray thus restoring adequate NPSH. These low temperature cases are less challenging, in terms of accident mitigation, than the cases analyzed with maximized suppression pool temperature. It is concluded that the NPSH analysis as performed for the DBA-LOCA is conservative and bounding. The basis for this conclusion is that the NPSH margin for the DBA-LOCA is restricted by the limitations that the severe conditions impose on plant operators; that is, there are no options available except to maximize cooling with the remaining single loop of containment heat removal under the DBA-LOCA conditions. For other cases with lower pool temperatures, the NPSH margin can be improved by operator actions that would be allowed under the circumstances.

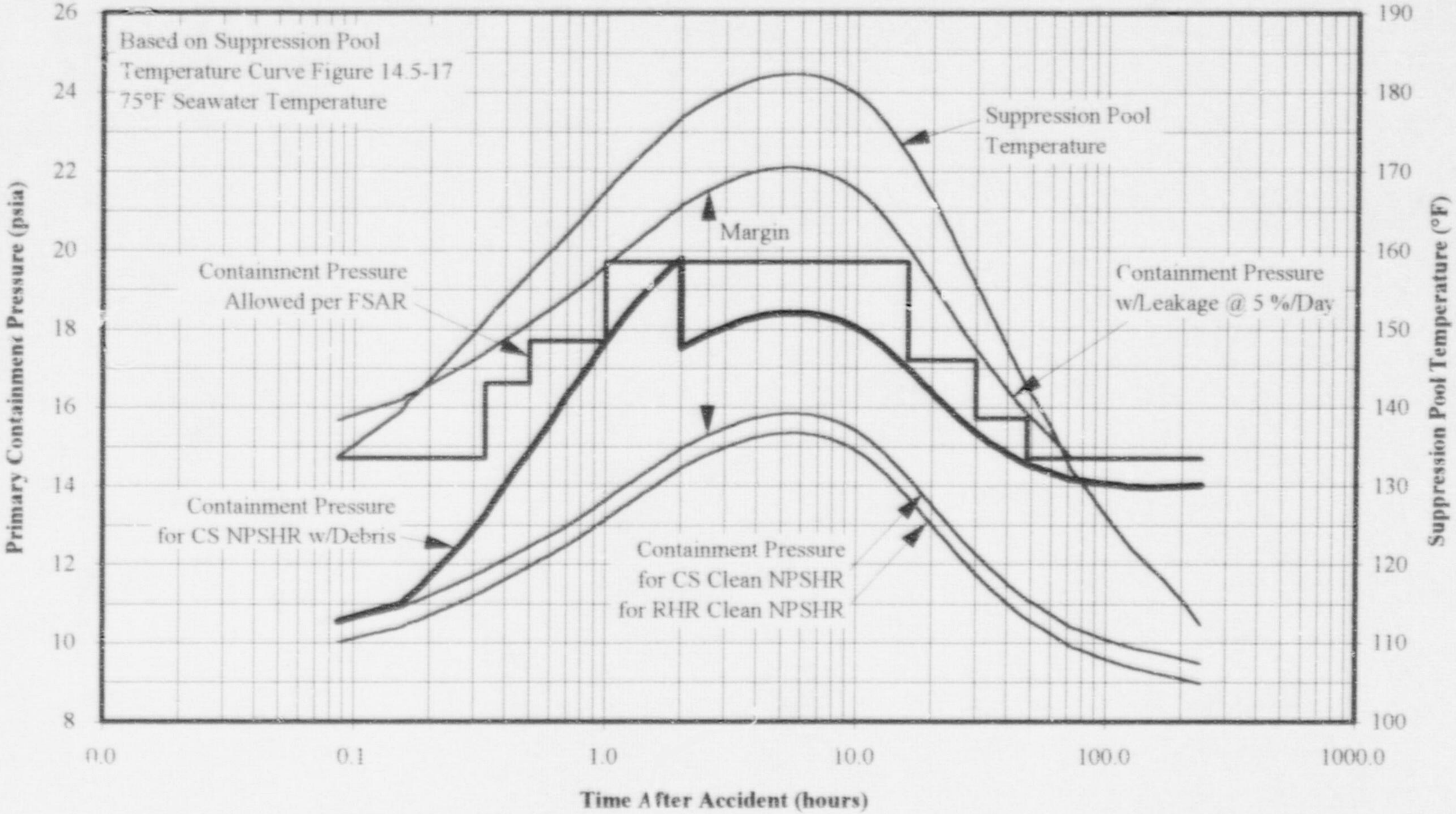
Based on Suppression Pool
Temperature Curve Figure 14.5-17
75°F Seawater Temperature
Suppression Pool
Temperature
Margin
Containment Pressure
Allowed per FSAR
Containment Pressure
w/Leakage @ 5 %/Day
Containment Pressure
for CS NPSHR w/Debris
Containment Pressure
for CS Clean NPSHR
for RHR Clean NPSHR
Primary Containment Pressure (psia)
Suppression Pool Temperature (°F)
Time After Accident (hours)
26
24
22
20
18
16
14
12
10
8
190
180
170
160
150
140
130
120
110
100
0.0
0.1
1.0
10.0
100.0
1000.0

Figure 1

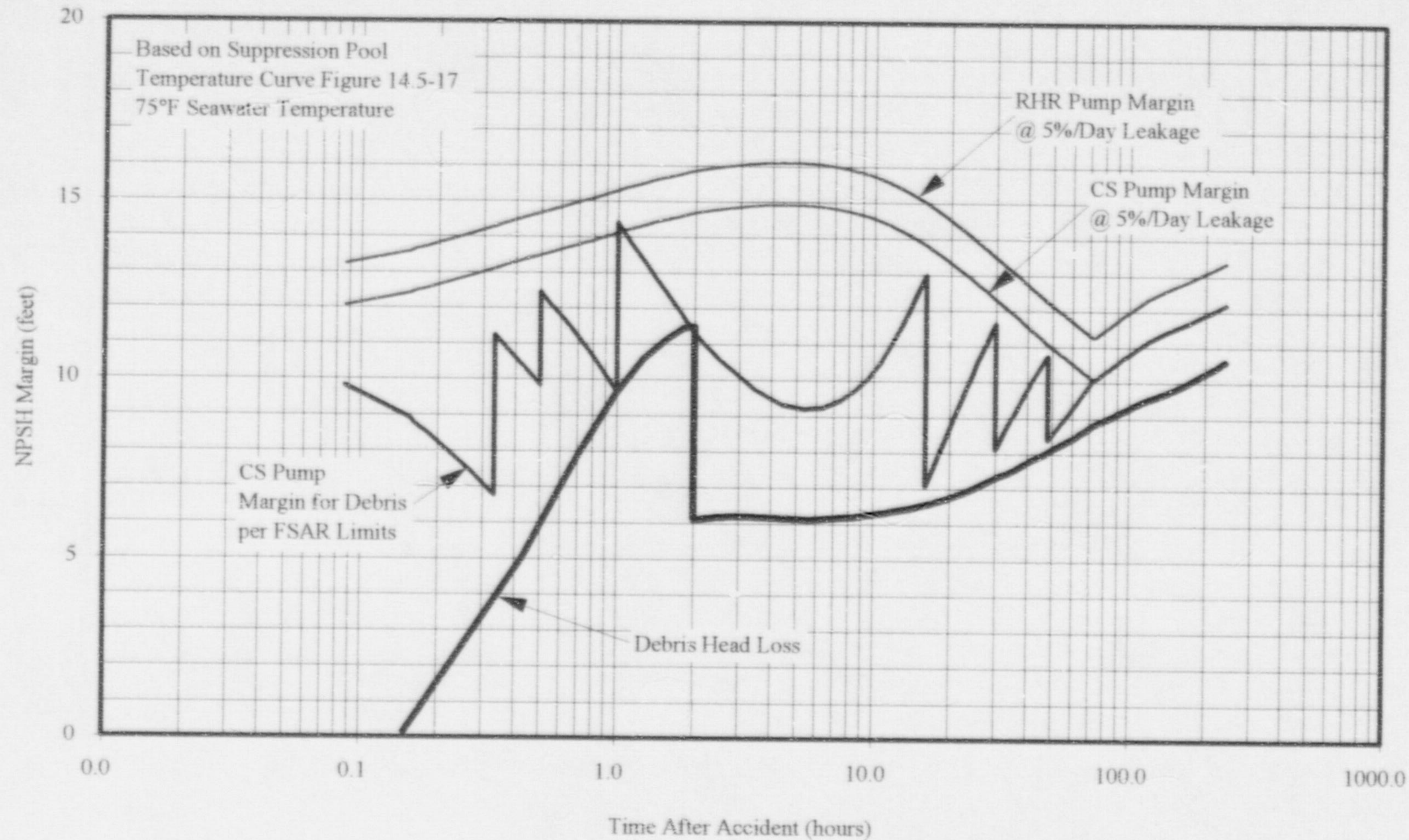
Based on Suppression Pool
Temperature Curve Figure 14.5-17
75°F Seawater Temperature
RHR Pump Margin
@ 5%/Day Leakage
CS Pump Margin
@ 5%/Day Leakage
CS Pump
Margin for Debris
per FSAR Limits
Debris Head Loss
NPSH Margin (feet)
20
15
10
5
0
0.0
0.1
1.0
10.0
100.0
1000.0
Time After Accident (hours)

Figure 2

ATTACHMENT 2 TO BECO LETTER 2.99.001

Proposed Updated Final Safety Analysis Report (UFSAR) Changes

INSERT 1 - Section 4.8.5.1 General Description (RHR System)

(replace existing paragraph)

The effects on available NPSH for the RHR pumps due to a postulated accumulation of LOCA generated debris on the suction strainers in the suppression pool was evaluated in accordance with Regulatory Guide 1.82, Revision 2. The RHR and core spray suction strainers in each loop were replaced with a large capacity (670 ft^2) stacked disk strainer spanning the width of one torus bay and connected to the three pumps. The debris analysis determined the maximum volume of shredded fiberglass, sludge, dirt/dust, rust flakes, and paint chips generated from the bounding line break inside primary containment. Based on a bounding analysis for debris generation, transport, and accumulation, the increase in suction strainer head loss is within the margin for NPSH available to the RHR pumps following the design basis LOCA. Refer to Section 14.5.3 for the NPSH evaluation.

INSERT 2 - Section 6.4.3 Core Spray System

(replace existing paragraph)

The effects on available NPSH for the core spray pumps due to a postulated accumulation of LOCA generated debris on the suction strainers in the suppression pool was evaluated in accordance with Regulatory Guide 1.82, Revision 2. The RHR and core spray suction strainers in each loop were replaced with a large capacity (670 ft^2) stacked disk strainer spanning the width of one torus bay and connected to the three pumps. The debris analysis determined the maximum volume of shredded fiberglass, sludge, dirt/dust, rust flakes, and paint chips generated from the bounding line break inside primary containment. Based on a bounding analysis for debris generation, transport, and accumulation, the increase in suction strainer head loss is within the margin for NPSH available to the core spray pumps following the design basis LOCA. Refer to Section 14.5.3 for the NPSH evaluation.

INSERT 3 - Section 14.5.3.1.3 Core Standby Cooling System Net Positive Suction Head

(replace existing paragraphs and table)

In accordance with the NRC Safety Evaluation Report for License Amendment [determined by NRC], the amount of containment positive pressure that may be included in a CSCS pump NPSH analysis has been limited to the following:

Time After Accident (sec)			Time After Accident (hour)			Containment Pressure (psig)	Containment Pressure (psia)
0	to	1,200	0.00	to	0.33	0.0	14.7
1,200	to	1,800	0.33	to	0.50	1.9	16.6
1,800	to	3,600	0.50	to	1.0	3.0	17.7
3,600	to	57,600	1.0	to	16.0	5.0	19.7
57,600	to	108,000	16.0	to	30.0	2.5	17.2
108,000	to	172,800	30.0	to	48.0	1.0	15.7
172,800	to	864,000	48.0	to	240.0	0.0	14.7

These limits on containment pressure are included in the evaluation of LOCA debris head losses for the RHR and core spray pumps and the resulting NPSH available for long-term containment heat removal. There remains sufficient NPSH margin within these containment pressure limits to accommodate the postulated LOCA debris without affecting pump performance.

Determination of No Significant Hazards Considerations

To assist the NRC in its review, we have prepared the following "No Significant Hazards" evaluation using the standards of 10 CFR 50.92.

(1) *Will crediting the proposed post-LOCA containment pressure in ECCS analysis involve a significant increase in the probability or consequences of an accident previously evaluated?*

Chapter 14 of the FSAR contains evaluations of the worst postulated accidents that the Pilgrim plant was evaluated for, which include the refueling accident, the main steam line break outside primary containment, the recirculation line break inside primary containment, and the control rod drop accident. No increase in the probability of the evaluated accidents will result from crediting the proposed containment pressure because post-LOCA containment pressure does not represent an accident initiator but, rather, is an expected condition that will inherently exist in the containment after the pipe break inside containment.

The worst radiological consequences for the Pilgrim plant are associated with the design basis LOCA which is the double guillotine failure of the recirculation system piping. The radiological analysis of this event contained in FSAR Chapter 14 uses a TID-14844 source term and assumes a 1.5% per day leakage from the containment, which is greater than the maximum leakage allowed by the Technical Specifications. The results of this analysis are presented in Table 14.5-2 of the FSAR and indicate substantial margin when compared to 10 CFR Part 100 limits.

The radiological consequences of the design basis accident are not increased by taking credit for the post-LOCA suppression pool overpressure. Assuming containment integrity exists, the mechanism for increasing the consequences of the accident would be an increased leakage rate caused by an increase of the average differential pressure between primary and secondary containment during the accident response. However, the NPSH analysis performed for Pilgrim that includes post-LOCA containment pressure does not assume or require that the differential pressure between primary and secondary containment be maintained above the lower bounding minimum that exists due to thermal equilibrium conditions between the containment atmosphere and the suppression pool. Specifically, the containment pressure included in the ECCS pump NPSH analysis is inherently provided by the increase in wetwell vapor pressure and air/nitrogen partial pressure that exists due to equilibrium with increasing pool temperature with an accounting for containment initial conditions and leakage.

Inclusion of the post-LOCA containment pressure in the calculation of NPSH does not require that a higher containment pressure than would otherwise occur be purposely maintained, no requirement is incurred to delay operating containment heat removal equipment at the highest rate possible, no requirement is incurred to deliberately continue any condition of high containment pressure to maintain adequate NPSH, and no requirement is incurred for the purposeful addition of air/nitrogen into the containment to increase the available pressure.

The higher debris head losses that required the new NPSH evaluation are based on an updated analysis of LOCA-generated debris. The new debris analysis was performed in response to NRC Bulletin 96-03 using the guidance given in Regulatory Guide 1.82, Revision 2. The NRC guidance is used to ensure sufficient NPSH margin exists to pressure limits included in this submittal. It is shown there is sufficient NPSH margin at all times following the bounding design basis accident.

Based on these reasons, the probability of accidents previously evaluated is not increased and the consequences of the design basis accident are not increased.

(2) *Will crediting the proposed post-LOCA containment pressure create the possibility for new or different kinds of accidents?*

As stated above, Chapter 14 of the FSAR contains the worst postulated accidents that the Pilgrim plant was evaluated for, which include the refueling accident, the main steam line break outside primary containment, the recirculation line break inside primary containment, and the control rod drop accident. New or different types of accidents are not created by including the containment pressure in NPSH analyses because post-LOCA containment pressure is an expected condition that will exist in the containment after the pipe break inside containment. The pressure included in the NPSH analysis is the minimum pressure that will exist due to thermal equilibrium conditions and must be considered as part of any accident analysis regardless of whether it is used in the evaluation of NPSH.

(3) *Will crediting the proposed new limits for post-LOCA containment pressure in ECCS NPSH analyses involve a significant reduction in a margin of safety?*

The integrity of the primary containment and the operation of the ECCS systems in combination limit the off-site doses to values less than those suggested in 10 CFR 100 in the event of a break in the primary system piping. In order for the ECCS pumps to meet their performance requirements, the NPSH available to the pumps throughout the accident response must meet their specific NPSH requirements. Excess NPSH margin will not improve the performance of the ECCS pumps because NPSH available must only meet NPSH requirements for the pump to operate on its pump curve and meet design expectations.

Including the proposed post-LOCA containment pressure in NPSH analyses increases the NPSH available to the ECCS pumps, but the methodology used includes only that pressure that will inherently exist due to thermal equilibrium between the containment atmosphere and the suppression pool because of the primary containment enclosure with an accounting for leakage. Post-accident containment pressure calculated in such a manner represents a conservative lower bound for the pressure that will be available. Therefore, it is expected the actual NPSH margin will exceed that calculated by these methods. The proposed pressure limits are enveloped at all times by the containment pressure calculated using the thermal equilibrium methodology. These methods for calculating NPSH available and NPSH margin were previously reviewed by the NRC for License Amendment 173.

The new debris analysis referenced in this submittal was done in accordance with Regulatory Guide 1.82, Revision 2. The LOCA debris analysis is considered conservative and bounding for all postulated accidents and transients. It is shown that, within the proposed containment pressure limits, there is sufficient NPSH margin at all times following the design basis accident to accommodate the debris head loss without affecting RHR or core spray pump performance.

Based on the above discussion, credit for the updated values of containment pressure in accommodate the debris resulting from a LOCA. Using the proposed containment ECCS NPSH analyses does not involve a reduction in the margin of safety.

This proposed license change was reviewed and recommended for approval by the Operations Review Committee and reviewed by the Nuclear Safety Review and Audit Committee.