



10CFR50.90

**Boston Edison**

Pilgrim Nuclear Power Station  
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Vice President Nuclear Operations  
and Station Director

January 30, 1997  
BECo Ltr. 2.97.008

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

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

**Subject: Significant Hazards Evaluation for Pilgrim Nuclear Power Station's Net Positive Suction Head Analyses**

Reference: BECo letter to the NRC dated January 20, 1997(#2.97.004)

**Purpose**

In the referenced letter, Pilgrim requested the NRC to review expeditiously and approve credit for post accident wetwell airspace pressure in Pilgrim's NPSH analyses performed for certain emergency core cooling system pumps. The following significant hazards evaluation is provided to assist the NRC in that review.

**Background**

In 1984, Pilgrim replaced recirculation system piping and, along with the modification, also replaced the drywell reflective metal insulation with NUKON insulation. Safety Evaluation #1638 was prepared to evaluate this modification under the 10CFR50.59 process. In 1995, while performing additional analyses for another purpose, an error was discovered in Safety Evaluation #1638. Safety Evaluation #2971 was prepared to supersede #1638, and the docket was corrected by Boston Edison Letter #2.96.064 to the NRC dated June 28, 1996.

The NRC is currently reviewing Safety Evaluation #2971. One of the issues under review is the acceptability of including positive wetwell airspace pressure in the calculation of the NPSH margin for the ECCS pumps. The referenced letter of January 20, 1997, requested NRC review and approval for taking credit for post-LOCA pressure in the NPSH margin calculations.

The suppression pool coolant inventory is used post-LOCA to mitigate and control the consequences of the LOCA. This coolant inventory is recirculated by the emergency core coolant system (ECCS) pumps into the reactor vessel for long-term cooling. The pumps require net positive suction head (NPSH) to achieve their rated performance.

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## Determination of No Significant Hazards Considerations

To assist the NRC in its review, we have prepared the following significant hazards evaluation using the standards of 10CFR50.92.

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

Chapter 14 of the FSAR contains evaluations of the design basis accidents, 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 post-LOCA wetwell airspace pressure because post-LOCA wetwell airspace pressure does not represent an accident initiator but is rather a byproduct of the conditions which will 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 wetwell airspace pressure. 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 analyses performed for Pilgrim, which credits the post-LOCA wetwell airspace, does not require that the differential pressure between primary and secondary containment be maintained above the minimum that exists due to the equilibrium conditions based on the suppression pool temperature. Specifically, the wetwell airspace pressure credited in the ECCS pump NPSH analyses is provided by an increase in wetwell vapor pressure and air/nitrogen partial pressure in equilibrium with increasing pool temperature with an accounting for containment initial conditions and leakage.

By crediting the post-LOCA wetwell airspace pressure in the calculation of NPSH, no requirement is created to purposely maintain a higher containment pressure than would otherwise occur; 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.

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 post-LOCA wetwell airspace pressure create the possibility for new or different kinds of accidents?*

As stated above, Chapter 14 of the Pilgrim FSAR contains evaluations of design basis accidents that 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 crediting the post-LOCA wetwell airspace pressure because post-LOCA wetwell airspace pressure does not represent an accident initiator but is rather a byproduct of the conditions which will exist in the containment after the pipe break inside containment.

Therefore, crediting post-LOCA wetwell airspace pressure does not create the possibility for new or different kinds of accidents from those previously analyzed.

- (3) *Will crediting post-LOCA wetwell airspace 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 10CFR100 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.

Crediting post-LOCA wetwell airspace pressure in ECCS NPSH analyses increases the NPSH available to the pumps connected to the suppression pool but limits the increase in NPSH available consistent with the bounding leakage assumptions for the containment system. The amount of post-accident pressure that is utilized in ECCS NPSH analyses is calculated in a manner such that the pressure credited represents a conservative lower bound of the pressure available. Therefore, it is expected that the NPSH margin will exceed that credited in the NPSH analyses.

Credit for wetwell airspace pressure in NPSH analyses is not required under all circumstances. If the suction strainers for the ECCS pumps remain relatively free of post-LOCA debris, adequate NPSH will be available without credit for the wetwell airspace pressure provided by the post-LOCA heatup of the air/nitrogen gas in the containment. If debris accumulates on the pump suction strainers, the NPSH available to the ECCS pumps will be decreased due to the head loss caused by the debris. Credit for the post-LOCA wetwell airspace pressure in the analyses indicates that there is adequate NPSH margin such that NPSH available will remain above NPSH required, and ECCS pump performance will meet applicable requirements. Based on the above discussion credit for wetwell airspace pressure in ECCS NPSH analyses does not involve a significant reduction in the margin of safety.

#### Conclusion

Based on the above, it is determined that there are no significant hazards created by crediting wetwell airspace pressure in NPSH analyses.

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

  
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