BOSTON EDISON
Pilgrim Nuclear Power Station
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E. S. Kraft, Jr.
Vice President Nuclear Operations
and Station Director

February 11, 1993

BECo 93-016

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

License DPR-35
Docket 50-293

PROPOSED TECHNICAL SPECIFICATION CHANGE
PILGRIM NUCLEAR POWER STATION SPENT FUEL STORAGE CAPACITY EXPANSION

References: 1. HOLTEC International Report HI-92925, "Pilgrim Nuclear Power Station Spent Fuel Storage Capacity Expansion", dated December, 1992. (Attached)

2. Amendment No. 33 to Pilgrim Nuclear Power Station (PNPS) Operating License No. DPR-35, dated August 17, 1978

Boston Edison Company (BECo) proposes the attached modification to the Technical Specifications, Appendix A of Operating License DPR 35 for the Pilgrim Nuclear Power Station (PNPS) in accordance with 10CFR50.90.

The proposed modification to the Technical Specifications does the following:

- Increases the allowed fuel assembly storage cells from 2320 to 3859
- Changes the maximum loads allowed to travel over the spent fuel assemblies from 1000 lbs. to 2000 lbs.
- Changes the limiting characteristics of assemblies to be stored in the spent fuel from a maximum $K_{infinity} \leq 1.35$ to a maximum $K_{infinity} \leq 1.32$ and a maximum lattice average Uranium enrichment of $\leq$ 4.6% by weight.

The increase in the fuel assembly storage cells is accomplished by installing six additional stainless steel storage racks with Boral as the neutron absorbing material. The new storage racks will be designed and installed in the spent fuel pool such that the K_{eff} of the pool with spent fuel assemblies will be less than or equal to 0.95. The proposed change in the maximum allowable loads traveling over the spent fuel assemblies is required to accommodate the installation of storage platforms over the new storage racks.

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The proposed limitations on the $K_{infinity}$ and Uranium enrichment of fuel assemblies to be loaded in the spent fuel pool ensures the $K_{effective}$ of the spent fuel pool remains less than 0.95. The attached HOLTEC Report, HI-92925, provides the design basis for the proposed spent fuel storage racks and an analysis supporting the proposed modification of the Technical Specifications. This report has been reviewed and accepted by our Nuclear Engineering Department.

By Amendment No. 33 to the PNPS Operating License, the Nuclear Regulatory Commission authorized Boston Edison Company to increase the spent fuel storage capacity to 2320 cells. The NRC Safety Evaluation supporting the amendment concluded there is no impact on the Final Environmental Statement previously issued by the Commission in granting Operating License DPR-35 to PNPS. Our review of the NRC's Safety Evaluation indicates the environmental findings and conclusions reached by the NRC in granting Amendment No. 33 are applicable to this proposed amendment.

The Boston Edison Company requests the NRC's approval of the proposed modification to the Technical Specifications by January, 1994, to allow our preparation for installation of new racks. To maintain full core off-load capability during and beyond Refueling Outage #10 (planned for April, 1995), we intend to install the first two new racks in the Fall of 1994.

E. S. Kraft
Vice President Nuclear Operations
and Station Director

Commonwealth of Massachusetts)
County of Plymouth)

Then personally appeared before me, E. S. Kraft, who being duly sworn, did state that he is Vice President Nuclear Operations and 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 in said submittal are true to the best of his knowledge and belief.

My commission expires: October 5, 1995 Peter M. Kahler
DATE NOTARY PUBLIC

PETER M. KAHLER NOTARY PUBLIC

Attachments:
A. Description of Proposed Modification to the Technical Specifications
B. Replacement Technical Specification Pages
C. Marked-Up Technical Specification Pages
D. HOLTEC Report, HI-92925, "Pilgrim Nuclear Power Station Spent Fuel Storage Capacity Expansion."

1 signed original and 37 copies
cc: See next page

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ATTACHMENT A TO BECO 93-016
DESCRIPTION OF PROPOSED MODIFICATION TO THE
TECHNICAL SPECIFICATIONS

PROPOSED MODIFICATION TO THE TECHNICAL SPECIFICATIONS

Boston Edison Company proposes to modify the Pilgrim Nuclear Power Station (PNPS) Technical Specification sections 5.5.C, D and E as follows:

Specification 5.5.C is revised to change the $K_{infinity}$ factor from 1.35 to 1.32 for U-235 enrichment up to 4.6% averaged over the axial planar zone of highest average enrichment. Specification 5.5.D is revised to increase the Spent Fuel Pool (SFP) storage capacity from 2320 to 3859 storage cells. Specification 5.5.E is revised to change the maximum loads allowed to travel over the fuel assemblies from 1000 lbs. to 2000 lbs. to allow for the installation of an overhead platform upon which equipment may be stored.

This proposed Technical Specification change will support the installation of six additional spent fuel storage racks in the spent fuel pool, increasing the cumulative storage capacity of the pool to 3859 fuel assemblies. The new storage racks are stainless steel with Boral as the neutron absorbing material. At present, the spent fuel pool has 2333 storage cells. PNPS is currently licensed to store up to 2320 spent fuel assemblies by Specification 5.5.D. The additional six racks plus the existing 2333 storage cells will provide a cumulative storage capacity of 3859. This will extend the reserve full core off-load capability through the year 2012. The current storage cell capacity provides storage for spent fuel; however, reserve for full core off-load capability will be lost during and beyond Refueling Outage #10 (1995).

The rack installation and the associated overhead platforms will be accomplished in accordance with our commitments to NUREG-0612, "Control of Heavy Loads to Nuclear Power Plants". An overhead platform will be placed on each of the new racks after storage cells are filled with spent fuel assemblies. Thus the existing specification limit of 1000 lbs. must increase to 2000 lbs. to allow for the platform installation. The new platform together with the lifting device weighs approximately 1850 lbs.

The maximum $K_{infinity}$ limit of fuel to be stored in the spent fuel pool is changed from 1.35 to 1.32. Additionally, to reflect the fact the reactivity of the fuel in the spent fuel pool is a function of U-235 enrichment as well as $K_{infinity}$ of the fuel in the standard core geometry, a limit on U-235 enrichment of 4.6% wt is imposed. Together, these limits ensure $K_{effective}$ of the pool will remain $\leq$ 0.95 for all anticipated pool conditions, including both abnormal and accident conditions.

While the proposed change allows the addition of six storage racks containing a total of 1526 cells, only two racks will be installed in the fuel pool upon receipt of NRC's approval of this proposed Technical Specification amendment. Two racks provide an immediate 558 cell increase in storage capacity .

This interim increase will enable us to operate PNPS with full core off-load capability until cycle #13 (now calculated to be the year 2003). Additional storage racks will be installed in the spent fuel pool as necessary.

BASIS FOR THE PROPOSED MODIFICATION

The attached HOLTEC Report HI-92925, "Pilgrim Nuclear Power Station Spent Fuel Storage Capacity Expansion", dated December 1992, provides the design basis and safety analysis performed to demonstrate the new spent fuel racks and the existing racks comply with applicable industry codes and standards. The report also provides information requested by the NRC position contained in "OT Position for Review and Acceptance of Spent Fuel Storage and Handling Applications", published in 1978 with a 1979 Addendum thereto.

EFFECTS ON SAFETY FUNCTIONS

Spent Fuel Storage Rack Design Review:

The additional new free-standing high density spent fuel storage racks will store fuel in discrete modules in the Spent Fuel Pool (SFP) with one module available for installation in the cask pit. Each cell is designed for storage of BWR fuel assemblies with $K_{infinities}$ in the standard core geometry of up to 1.32 and Uranium-235 enrichments up to 4.6% wt (with credit for burnable poison) while maintaining the required subcriticality ($K_{eff} \leq 0.95$). While the HOLTEC Report discusses $K_{infinity}$ for U-235 enrichment up to 4.9% wt., the proposed Technical Specification limits the U-235 enrichment to 4.6% wt. to maintain additional conservatism.

The high density spent fuel storage rack cells are fabricated from 0.090-inch thick type 304L stainless steel (S/S) sheet material. The basic building block of the racks is a six-inch (nominal) box of 304L S/S fabricated from precision sheared channels. The Boral panels are located between the checkerboard boxes and the sheathing without a water gap. The cells are welded together in a specified manner to become a free-standing structure that is seismically qualified without depending on neighboring modules or fuel pool walls for support. The nominal center-to-center spacing of the cells is 6.05 inches.

Safety Assessment:

The safety assessment of the proposed rack modules demonstrates their thermal-hydraulic, criticality and structural compliance with established requirements. Thermal-hydraulic compliance requires fuel cladding will not fail due to excessive thermal stress, and the steady state pool bulk temperature will remain within the limits prescribed for the spent fuel pool. Structural compliance is demonstrated by analysis showing the free-standing modules will not affect the spent fuel assemblies under all postulated seismic events, and the primary stresses in the module structure will remain below the ASME Code allowables. Analyses of the new and existing racks are presented in the attached HOLTEC Report. The structural qualification includes analytical demonstration that the subcriticality of the stored fuel will be maintained under accident scenarios such as fuel assembly drop or accidental misplacement of fuel outside a rack.

The criticality safety analyses demonstrates the neutron multiplication factor for the stored fuel array is bounded by the Technical Specification limit of 0.95 under assumptions of 95% probability and 95% confidence for both new and existing racks. The criticality analysis also sets the requirements on the length and density of the B-10 rod.

Since spent fuel is presently stored in the PNPS spent fuel pool, special administrative controls and procedures will be used to minimize radiation exposure during the installation of the new spent fuel racks. The evaluation of postulated accidents with respect to nuclear criticality and radioactivity release has shown acceptable results. K_{eff} does not exceed 0.95, including uncertainties, and postulated releases do not exceed 10CFR100 acceptance criteria as described in HOLTEC Report HI-92925, Sections 4 and 9.

The analyses presented in the report clearly demonstrate the rack module arrays possess wide margins of safety from all key (thermal-hydraulic, criticality, structural, and radiological) vantage points. The following "No Significant Hazards Consideration" evaluation is based on the analyses described in the report.

NO SIGNIFICANT HAZARDS CONSIDERATION DETERMINATION

The following evaluation demonstrates the proposed amendment does not exceed any of the three significant hazards considerations criteria of 10CFR50.92(c). The analysis of this proposed modification has been accomplished using currently accepted codes and standards. The three criteria are discussed below:

(1). The proposed amendment does not involve a significant increase in the probability or consequences of an accident previously evaluated.

The analyses performed by HOLTEC demonstrate the acceptability of the proposed Spent Fuel Storage expansion from a variety of perspectives. The analyses demonstrate K_{eff} will remain within acceptable limits even if an abnormal event, such as a fuel assembly misloading or assembly drop, should occur. It also has been demonstrated the spent fuel pool cooling system will continue to provide acceptable cooling of the stored assemblies, and there is sufficient time to take appropriate corrective action should all cooling be inadvertently lost. The racks are designed to seismic Class I requirements. An assembly inadvertently dropped on the racks would not prohibit the racks from performing their design function. The radiological consequences of a fuel handling accident remains within previously-established limits.

Movement of fuel assemblies and racks necessary for rack installation will be performed in accordance with our commitments to NUREG 0612, entitled: "Control of Heavy Loads at Nuclear Power Plants." Thus, the probability of an accident involving assembly damage will not be significantly increased. Based on these considerations, the probability or consequences of a previously evaluated accident is not significantly increased by installation activities.

To support the above conclusion, BECo has considered the following potential scenarios:

- A spent fuel assembly drop in the spent fuel pool.
- A loss of spent fuel pool cooling system flow.
- A seismic event.
- A construction accident.

As detailed in Section 4 of HOLTEC Report HI-92925, BECo evaluated the consequences of a spent fuel assembly drop in the spent fuel pool and found the criticality acceptance criterion, $K_{eff} \leq 0.95$, is not violated. Also there is no significant change in the radiological consequences of a fuel assembly drop from the previous analyses [illegible] the calculated doses are well within 10CFR100 guidelines. Analysis s[illegible] that dropping a spent fuel assembly on the racks will not prohibit the racks from performing their safety function. Thus, the consequences of this type of accident are not significantly changed from the previously evaluated spent fuel assembly drops.

Certain racks in the pool will be equipped with overhead storage platforms. These platforms are flat plate structures. They serve to store miscellaneous items and protect the fuel assemblies stored underneath from damage. Dropping the platform from a height of 4 inches above the rack (a possible situation if the platform is ever moved in the pool) was analyzed. It was determined that dropping spent fuel from 4" above the racks is a more severe event than a 4" drop of the platform with an assumed dry weight of 2000 lbs. Therefore, the fuel drop scenarios bound the platform drop condition.

During refueling activities, when the heat load in the pool is greatest, an intertie is available between the fuel pool cooling system and either loop of the Residual Heat Removal (RHR) system. The RHR pump and heat exchanger configuration provides greater cooling capacity for full core off-loads and as a backup to the normal fuel pool cooling system. This system will function during a loss of offsite power by utilizing emergency diesel generator AC power. The analysis in Section 5 of HOLTEC Report HI-92925 determined cooling capacities and maximum temperatures as well as the time-to-boil without cooling. The calculations show that if cooling is lost at the instant when the pool water reaches its maximum value during a full core off-load, there is a minimum of 6.4 hours before bulk boiling can occur.

During reactor power operation, the normal fuel pool cooling system is used with either of the two pumps and heat exchangers capable of maintaining the fuel pool well below boiling. In the event of a loss of offsite power, a temporary AC power interconnection is used to operate one or both pumps. Due to lower spent fuel pool heat loads during plant operation, more than 16 hours are available before bulk boiling can occur. Thus, the consequences of this event type are not significantly increased from previously- evaluated loss of cooling system flow events.

The consequences of a seismic event have been evaluated. The additional new racks will meet design and fabrication requirements of applicable NRC Regulatory Guides and industry standards. Seismic analyses on the new and existing racks were performed using both single rack 3-D (opposed phase motion) and Whole Pool Multi-Rack (WPMR) models. The results of these analyses indicate a large margin of kinematic and stress safety. The kinematic margin against rack-to-rack impact is at least 1 7/8 inches or rack-to-wall impact is at least 2 7/16 inches for all racks in the pool. Likewise, the maximum rack primary stresses under the Safe Shutdown Earthquake (SSE) condition are less than 50% of the allowable ASME Code value. Finally, the maximum bending moments and through-thickness shear in the supporting pool structure under factored load conditions are less than 80% of the respective allowables. The new free-standing racks are designed, as are the existing free-standing racks, so that the integrity of the racks and the pool structure is maintained during and after a seismic event. Thus, the consequences of a seismic event are not increased from previously evaluated events.

The consequences of a construction accident have been considered. A heavy load will not be carried in the spent fuel pool area until all fuel in the pool has decayed for a minimum of three months. Per NUREG 0612 this provides sufficient time for the decay of gaseous radionuclides in the fuel (gap activity) such that an assumed accidental release of gasses from damage to all stored fuel assemblies results in a potential offsite dose less than 10CFR100 limits. In addition, there is no equipment essential to the safe shutdown of the reactor or employed to mitigate the consequences of an accident beneath, adjacent to, or otherwise within the area of influence of any loads to be handled during this expansion modification. Therefore, the consequences of a construction accident are not significantly increased from previously evaluated events.

NUREG-0554, entitled: "Single-Failure-Proof Cranes for Nuclear Power Plants", provides guidance for the design, fabrication, installation and testing of new cranes that are of a high reliability design. NUREG-0612, Appendix C, entitled: "Modification of Existing Cranes," provides guidelines on the implementation of NUREG-0554 at operating plants. An evaluation of storage rack movements to be performed by the PNPS Reactor Building crane demonstrated the probability of a drop of a storage rack is extremely small. The Reactor Building crane has a rated capacity of 100 tons and incorporates a design safety factor of five. The maximum weight of any existing or replacement storage rack and its associated handling tool is 15 tons. Therefore, there is an ample safety factor margin for movements of the storage racks by the Reactor Building crane.

Therefore, it is concluded that the proposed amendment supporting the addition of spent fuel racks in the spent fuel pool does not involve a significant increase in the probability or consequences of any accident previously evaluated.

(2). The proposed amendment does not create the possibility of a new or different kind of accident from any accident previously evaluated.

No unproven technology is involved either in the installation process or in the analytical techniques necessary to justify the planned fuel storage expansion. The basic technology for fuel pool expansion has been developed

and demonstrated in over 80 applications for fuel pool capacity increases previously approved by the NRC.

HOLTEC has evaluated the proposed modification in accordance with the guidance of an NRC position paper entitled: "OT Position for Review and Acceptance of Spent Fuel Storage and Handling Applications," with appropriate NRC Regulatory Guides, with NRC Standard Review Plans, and with industry codes and standards. In addition, BECo has reviewed several previous NRC Safety Evaluation Reports for rack installation applications similar to this proposed modification.

Based upon the foregoing, the proposed rack installation does not create the possibility of a new or different of accident from any accident previously evaluated.

(3). The proposed amendment does not involve a significant reduction in a margin of safety.

The HOLTEC report demonstrates the acceptability of adding new racks from a variety of perspectives including criticality, thermal-hydraulic, radiological, seismic and structural considerations. The results of these analyses provide the basis for our conclusion that the changes do not involve a significant reduction in a margin of safety.

The established acceptance criterion for criticality is that the effective neutron multiplication factor in spent fuel pools shall be less than or equal to 0.95, including all uncertainties, under all conditions. This margin of safety has been adhered to in the criticality analysis methods in developing the new rack design.

The methods used in the criticality analysis conform to the applicable portions of the appropriate NRC guidance and industry codes, standards, and specifications. In meeting the acceptance criteria for criticality in the spent fuel pool such that K_{eff} is always less than or equal to 0.95, including uncertainties at a 95%/95% probability/confidence level, the proposed amendment does not involve a significant reduction in the margin of safety for nuclear criticality.

It is recognized that a one-to-one correspondence between the k-infinity of a bundle in the standard core geometry and the k_{eff} in the fuel rack does not exist. The effect of higher fuel enrichments on the neutron energy spectrum is to reduce the reactivity worth of the Boral absorber, resulting in a lower value of limiting $k_{infinity}$. In order to provide a complete specification of fuel that can be stored in the PNPS pool, the criteria for both k-infinity and fuel enrichment needs to be prescribed. Calculations have been performed to demonstrate that all fuel assemblies of up to 4.9% wt planar-average U-235 enrichment with a $k_{infinity}$ of 1.32 or less can be stored in the PNPS spent fuel pool with K_{eff} less than or equal to 0.95.

Conservative methods were used to calculate the maximum fuel temperature and the increase in temperature of the water in the spent fuel pool. The thermal-hydraulic evaluation used methods previously employed for evaluations of the present spent fuel racks to demonstrate the temperature margins of safety are maintained. The proposed modification will increase the heat load in the spent fuel pool. The evaluation shows the existing spent fuel cooling system

will maintain the bulk pool water temperature at or below 142°F during refueling.

The evaluation also shows that maximum local water temperatures along the hottest fuel assembly are below the nucleate boiling condition value. Thus, there is no significant reduction in the margin of safety caused by thermal-hydraulic or spent fuel cooling concerns.

The main safety function of the spent fuel pool and the racks is to maintain the spent fuel assemblies in a safe configuration through all normal or abnormal loadings. Abnormal loadings that have been considered are the effect of an earthquake, the drop of a spent fuel assembly, or the drop of any other heavy object. The mechanical, material, and structural design of the new spent fuel racks is in accordance with NRC guidance. The rack materials used are compatible with the spent fuel pool and the spent fuel assemblies. The structural considerations of the new racks and existing racks address margins of safety to preclude tilting, deflection or movement, thereby ensuring the racks do not impact each other during postulated seismic events. In addition the spent fuel assemblies remain intact and no criticality concerns exist. Thus, the margin of safety is not significantly reduced by the proposed rack additions.

Conclusion:

In view of the above, BECo has determined the proposed amendment does not involve significant hazards consideration and the criteria of 10CFR50.92 have been met.

This change has been reviewed and recommended for approval by the Operations Review Committee and reviewed by the Nuclear Safety Review and Audit Committee.

SCHEDULE OF CHANGE

This change will become effective 30 days following BECo's receipt of the Commission's approval.