ENCLOSURE 2

WATTS BAR NUCLEAR PLANT UNIT 1

PROPOSED TECHNICAL SPECIFICATION CHANGE
SPENT FUEL POOL STORAGE CAPACITY INCREASE

DETERMINATION OF
NO SIGNIFICANT HAZARDS CONSIDERATIONS

REVISION 1

WATTS BAR NUCLEAR PLANT (WBN) UNIT 1
SPENT FUEL POOL RERACKING AND ENRICHMENT INCREASE
NO SIGNIFICANT HAZARDS CONSIDERATIONS DETERMINATION
REVISION 1

Description of Proposed License Amendment

The proposed amendment would revise the WBN Unit 1 Technical Specifications to increase the enrichment and storage capacity of the spent fuel pool racks. The proposed modification increases the WBN spent fuel storage capacity from 484 fuel assemblies to 1835 fuel assemblies. The initial enrichment of the fuel to be stored in the spent fuel storage racks will be increased from 3.5 weight percent (wt%) to 5.0 wt%. This modification would also change the spacing of stored fuel assembly center-to-center spacing from a nominal 10.72 inches to 10.375 inches in 24 PaR flux trap rack modules and 8.972 inches in ten smaller burnup credit rack modules to be installed peripherally along the south and west pool walls and in a single 15 x 15 burnup credit rack to be installed in the cask pit.

In addition to the above proposed revisions, two limiting conditions for operation (LCOs) will be added to require that the combination of initial enrichment and burnup of each spent fuel assembly to be stored is in the acceptable region and to require boron concentration of the cask pit to be greater than or equal to 2000 parts per million (ppm) during fuel movement in the flooded cask pit. As an added protection to the fuel stored in the cask pit area, the Technical Requirements Manual (TRM) is being revised to require that an impact shield be in place over the fuel when heavy loads are moved near or across the cask pit area.

The WBN Unit 1 Technical Specification Bases and the Technical Requirements Manual would be revised to support these changes.

Basis for No Significant Hazards Consideration Determination

The Nuclear Regulatory Commission has provided standards for determining whether a significant hazards consideration exists (10 CFR 50.92(c)). A proposed amendment to an operating license for a facility involves no significant hazards consideration if operation of the facility in accordance with the proposed amendment would not (1) involve a significant increase in the probability or consequences of an accident previously evaluated; or (2) create the possibility of a new or different kind of accident from any accident previously evaluated; or (3) involve a significant reduction in a margin of safety. Each standard is discussed below for the proposed amendment.

(1) **Operation of the facility in accordance with the proposed amendment would not involve a significant increase in the probability or consequences of an accident previously evaluated.**

The following potential scenarios were considered:

1. A spent fuel assembly drop.
2. Drop of the transfer canal gate or the cask pit divider gate.
3. A seismic event.

4. Loss-of-cooling flow in the spent fuel pool.

5. Installation activities.

The effect of additional spent fuel pool storage cells fully loaded with fuel on the first four potential accident scenarios listed above has been considered. It was concluded that after installation activities have been completed, the presence of additional fuel in the pool does not increase the probability of occurrence of these four events. Also, based on evaluations of bulk pool temperature, rack seismic responses, and refueling accidents, it is reasonable to conclude that there is no significant increase in the consequences of these events after installation is complete (See Reference 1). During the installation activities, the following considerations support a conclusion that neither the probability or consequences of these four scenarios would be significantly increased.

A spent fuel assembly cannot be dropped during installation of the 24 Programmed and Remote System Corporation (PaR) flux trap rack modules because this activity will take place before the end of operating cycle one and there will be no spent fuel in the WBN pool to be moved or shuffled. Before installing the ten smaller burnup credit racks in the pool, some fuel will be moved to create a three foot lateral free zone clearance from stored fuel. This would involve a one-time movement of an estimated maximum of 225 fuel assemblies, which is less that half the fuel movements during one refueling outage. This does not significantly increase the probability of dropping a fuel assembly, particularly when the many administrative controls and physical limitations imposed on fuel handling operations are considered. The fuel handling system consists of equipment and structures utilized for safely implementing refueling operations in accordance with requirements of General Design Criteria 61 and 62 of 10 CFR 50, Appendix A. The radiological dose consequences of dropping a 5.0 wt% fuel assembly are different from the previous FSAR evaluation for the 3.5 wt% fuel assembly. The Beta and Gamma doses decrease and the maximum thyroid dose increase is less than 9%. Therefore, the change in calculated dose values is insignificant and remains well within regulatory guidelines (See Reference 2).

It may be necessary to move the transfer canal gate and the cask pit divider gate between their gated and stored positions during installation of the burnup credit "baby" rack modules along the south and west walls. During rack installation, the previously mentioned three foot lateral free zone clearance to stored fuel would exist. Therefore, no heavy load would be carried directly over irradiated fuel during installation of the racks. There are numerous design features which comply with NUREG-0612 to preclude these gates from dropping on spent fuel. These features include design of the lifting devices, design of the crane, and use of written procedures (See Reference 3). Also, the evaluation results for a gate drop on the racks (Reference 6) indicates that permanent damage to a fuel storage cell is limited to a maximum depth of less than six inches below the top of the rack with no effect on the subcriticality of fuel stored in adjacent cells. Based on the foregoing, it is reasonable to conclude that gate handling during the installation of the "baby" racks would not involve a significant increase in the probability or consequences of an accident.

The probability of a seismic event is not related to installation activities. The worst consequence resulting from a seismic event during installation activities would occur during handling of a rack. The consequences would be insignificant because the Auxiliary Building crane is seismically qualified and both handling equipment and operations meet the criteria of NUREG-0612. Nevertheless, if the seismic event resulted in a rack drop, the consequences are insignificant, i.e., localized damage to the pool liner and a minor leak rate which would be small in comparison to available installed makeup capacity. The cooling and shielding of the spent fuel would remain unaffected. (See References 4 and 5). Also the racks being moved are empty during installation and therefore, the criticality consequences of seismic events are bounded by evaluations for loaded racks (See Reference 7).

Rack installation activities cannot cause an accidental loss-of-cooling flow in the spent fuel pool. The vital components of the spent fuel pool cooling and cleanup system (SFPCCS) are not located proximate to the pool installation activities. Coolant flow may be deliberately curtailed to facilitate installation of the "baby" racks directly beneath the discharge piping in the southwest corner of the pool. The effects of such an action would be readily minimized and made inconsequential during the detailed installation planning phase by selecting a time when decay heat input from stored fuel is relatively constant. Also careful preplanning of the work would minimize out-of-service time and provide for intermittent coolant flow restart, if necessary, to maintain acceptable bulk coolant temperatures. Similarly, the effect of an independently initiated loss-of-coolant flow incident on reracking activities can be easily accommodated by stopping work, as necessary, to mitigate any adverse effects on the installation process. The consequences of loss-of-cooling flow in the spent fuel pool during installation are bounded by the analysis in Chapter 5 of the report which includes the situation in which "baby" racks and the 15 x 15 cask pit rack are installed, and the pool is filled to capacity with spent fuel.

With regard to the actual installation activities, the existing WBN TRM prohibits loads in excess of 2059 pounds from travel over fuel assemblies in the storage pool and requires the associated crane interlocks and physical stops be periodically demonstrated operable. During installation, racks and associated handling tools will be moved over the spent fuel pool, however there will be no fuel in the pool when the 24 flux trap rack modules are installed. A three foot lateral free zone clearance from stored spent fuel will be maintained during installation of the ten smaller burnup credit rack modules. Installation work in the spent fuel pit area will be controlled and performed in strict accordance with specific written instructions.

NUREG-0612 states that in lieu of providing a single failure-proof crane system, the control-of-heavy-loads guidelines can be satisfied by establishing that the potential for a heavy load drop is extremely small. Storage rack movements to be accomplished with the WBN Auxiliary Building crane will conform with NUREG-0612 guidelines in that the probability of a drop of a storage rack is extremely small. The crane has a tested capacity of 125 tons. The maximum weight of any existing, replacement, or new storage rack and its associated handling tool is less than 20 tons. Therefore, there is ample safety factor margin for movements of the storage racks by the Auxiliary Building crane. Special lifting devices, which have redundancy or a rated capacity sufficient to maintain adequate safety factors, will also be utilized in the movements of the storage racks. In accordance with NUREG-0612, Appendix B, the safety margin ensures that the probability of a load drop is extremely low.

Future load travel over fuel stored in a rack specifically designed for the cask loading area of the cask pit will be prohibited unless an impact shield, which has been specifically designed for this purpose, is covering the area. Loads that are permitted when the shield is in place must meet analytically determined weight, travel height, and cross-sectional area criteria that preclude penetration of the shield. A Technical Requirement (TR) has been proposed that incorporates the previously mentioned load criteria.

Also a rack changeout sequence is being developed that addresses removal of the existing racks, movement of the new racks into the Auxiliary Building, initial staging on the refueling floor, and final installation in the pool. The changeout sequence objectives include establishing lift heights, travel distances, and number of lifts to be as low as reasonably achievable. Accordingly, it is concluded that the proposed installation activities will not significantly increase the probability of a load-handling accident. The consequences of a load-handling accident are unaffected by the proposed installation activities.

The consequences of a spent fuel assembly drop were evaluated, and it was determined that the racks will not be distorted such that the racks would not perform their safety function. The criticality acceptance criterion, $K_{eff} \leq 0.95$, is not violated, and the calculated doses are well within 10 CFR Part 100 guidelines. The radiological consequences of the fuel assembly drop accident evaluated for WBN, have changed, however, the changes do not involve a significant increase in consequences and are well within the 10 CFR 100 requirements. (Reference 1).

A TRM change has been proposed that would permit the transfer-canal gate and the divider gate for the cask pit to travel over fuel assemblies in the spent fuel pool during movement between their gated and stored position. Rack damage is restricted to an area above the active fuel region, therefore, neither criticality nor radiological concerns exist.

The consequences of a seismic event have been evaluated. The replacement racks are designed and fabricated and the new racks will be fabricated to meet the requirements of applicable portions of the NRC regulatory guides and published standards. Design margins have been provided for rack tilting, deflection, and movement such that the racks do not impact each other or the spent fuel pool walls in the active fuel region during the postulated seismic events. The free-standing racks will maintain their integrity during and after a seismic event. The fuel assemblies also remain intact and therefore no criticality concerns exist.

The spent fuel pool system is a passive system with the exception of the fuel pool cooling train and heating, ventilating, and air-conditioning (HVAC) equipment. Redundancies in the cooling train and HVAC hardware are not reduced by the planned fuel storage modification. The potential increased heat load resulting from any additional storage of spent fuel is well within the existing system cooling capacity. Therefore, the probability of occurrence or malfunction of safety equipment leading to the loss-of-cooling flow in the spent fuel pool is not significantly affected. Furthermore, the consequences of this type incident are not significantly increased from previously evaluated cooling system loss of flow malfunctions. Thermal-hydraulic scenarios assume the reracked pool is approximately 90% full with spent fuel assemblies. From this starting point, the remaining storage capacity is utilized by analyzing both normal and unplanned full core off loads using conservative assumptions and previously established methods. Calculated values include maximum pool water bulk temperature, coincident maximum pool water local temperature, the maximum fuel cladding temperature, time-to-boil after loss-of-cooling paths, and the effect of flow blockage in a storage cell.

Although the proposed modification increases the pool heat load, results from the above analyses yield a maximum bulk temperature less than 160 degrees Fahrenheit which is below the bulk boiling temperature. Also the maximum local water temperature is below nucleate boiling condition values. Associated results from corresponding loss-of-cooling evaluations give minimums of 5.3 hours before boiling begins and 45 hours before the pool water level drops to the minimum required for shielding spent fuel. This is sufficient time to begin utilization of available alternate sources of makeup cooling water. Also, the effect of the increased thermal loading on the pool structure, associated cooling system, and components was evaluated and determined to establish an acceptable design basis with the new storage configuration. No modifications were necessary because of the increased temperature.

(2) **Operation of the facility in accordance with the proposed amendment would not create the possibility of a new or different kind of accident from any accident previously analyzed.**

The proposed modification has been evaluated in accordance with the guidance of the NRC position paper entitled, "OT Position for Review and Acceptance of Spent-Fuel Storage and Handling Applications"; appropriate NRC regulatory guidelines; appropriate NRC standard review plans; and appropriate industry codes and standards. Proven analytical technology was used in designing the planned fuel storage expansion and will be utilized in the installation process. Basic reracking technology has been developed and demonstrated in applications for fuel pool capacity increases that have already received NRC staff approval.

Proposed TSs for the spent fuel storage racks use burnup credit and fuel assembly administrative placement restrictions for criticality control. These restrictions are described in the proposed change to the design features section of the TSs by reference to the Spent Fuel Pool Modifications report. Additional evaluations were required to ensure that the criticality criterion, $k_{eff} \leq 0.95$, is maintained. These include evaluation for the abnormal placement of unirradiated (fresh) fuel assemblies of 5.0 wt% enrichment into a storage cell location designed for lower enrichment or irradiated fuel. Soluble boron, for which credit is permitted under these abnormal conditions, ensures that reactivity is maintained substantially less than the design requirement. For example, if the PaR flux trap racks are inadvertently all loaded with fresh assemblies of the maximum 5.0 wt% fuel instead of observing the 3.8 wt% and 6.75 MWD/KgU controls, the worth of the 2000 ppm borated water is sufficient to lower the k_{eff} of the storage racks to 0.83. The existing and proposed TSs require boron concentration in the pool and cask pit to be ≥ 2000 ppm during fuel movement. An analytical determination of the reactivity worth of 2000 ppm borated water in the spent fuel storage pool predicted the change in k_{eff} to be approximately 17 percent k_{eff}. Although no credit for soluble boron was proposed in the TSs, it was also determined by an independent calculation that a minimum concentration of 520 ppm soluble boron allows the unrestricted storage of 5.0 wt% enriched fuel in the PaR flux trap racks.

The Holtec-designed peripheral "baby" racks and the 15 x 15 racks in the cask loading area can safely and conservatively store fuel of 5 wt% initial enrichment burned to 41 MWD/kgU or lower enriched fuel with lower burnup, i.e., fuel of equivalent reactivity. Evaluations have confirmed that, for the abnormal placement of a fresh fuel assembly of 5.0 wt% in these racks, the criticality criterion is maintained with the existing and proposed TS requirements of 2000 ppm soluble boron.

Although these changes required addressing additional aspects of a previously analyzed accident, the possibility of a previously unanalyzed accident is not created.

The impact shield design together with its attendant administrative controls and NUREG-0612 heavy load lift compliance, renders the possibility of a heavy load drop on fuel as not credible in accordance with the NUREG-0612 single-failure-proof criteria. Accordingly, since this particular part of the proposed reracking modification is not a change that could malfunction by a new single failure, the movement of heavy loads over the cask pit does not create the possibility of a new or different kind of accident.

It is therefore concluded that the proposed reracking does not create the possibility of a new or different kind of accident from any previously analyzed.

(3) **Operation of the facility in accordance with the proposed amendment would not involve a significant reduction in a margin of safety.**

The design and technical review process applied to the reracking modification included addressing the following areas:

1. Nuclear criticality considerations.

2. Thermal-hydraulic considerations.

3. Mechanical, material, and structural considerations.

The established acceptance criterion for criticality is that the neutron multiplication factor shall be less than or equal to 0.95, including all uncertainties. The results of the criticality analyses for the rack designs demonstrate that this criterion is satisfied. The methods used in the criticality analysis conform to the applicable portions of NRC guidance and industry codes, standards, and specifications. In meeting the acceptance criteria for criticality in the spent fuel pool and the cask loading area, such that k_{eff} is always less than 0.95 at a 95/95 percent probability tolerance level, the proposed amendment does not involve a significant reduction in the margin of safety for nuclear criticality.

Conservative methods and assumptions were used to calculate the maximum fuel temperature and the increase in temperature of the water in the spent fuel pit area. The thermal-hydraulic evaluation used methods previously employed. The proposed storage modification will increase the heat load in the spent fuel pool, but the evaluation shows that the existing spent fuel cooling system will maintain the bulk pool water temperature at or below 160 degrees Fahrenheit. Thus it is demonstrated that the worst-case peak value of the pool bulk temperature is considerably lower than the bulk boiling temperature. 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 for thermal hydraulic or spent fuel cooling considerations.

The mechanical, material, and structural design of the spent fuel racks is in accordance with applicable portions of NRC's position in "OT Position for Review and Acceptance of Spent-Fuel Storage and Handling applications," dated April 14, 1978 (as modified January 18, 1979), as well as other applicable NRC guidance and industry codes. The primary safety function of the spent fuel racks is to maintain the fuel assemblies in a safe configuration through normal and abnormal loading conditions. Abnormal loadings that have been evaluated with acceptable results and discussed previously include the effect of an earthquake and the impact because of the drop of a fuel assembly. The rack materials used are compatible with the fuel assemblies and the environment in the spent fuel pool. The structural design for the new racks provides tilting, deflection, and movement margins such that the racks do not impact each other or the spent fuel pit walls in the active fuel region during the postulated seismic events. Also the spent fuel assemblies themselves remain intact and no criticality concerns exist. In addition, finite element analysis methods were used to evaluate the continued structural acceptability of the spent fuel pit. The analysis was performed in accordance with "Building Code Requirements for Reinforced Concrete," (ACI 318-63,77). Therefore, with respect to mechanical, material, and structural considerations, there is no significant reduction in a margin of safety.

Summary

Based on the above analyss, TVA has determined that operation of WBN, in accordance with the proposed amendment, would not: (1) involve a significant increase in the probability of consequences of an accident previously evaluated, (2) create the possibility of a new or different kind of accident from any accident previously evaluated, or (3) involve a significant reduction in a margin of safety. Therefore, operations of WBN in accordance with the proposed amendments as described do not involve significant hazard considerations as defined in 10 CFR 50.92 and that the criteria of 10 CFR 50.91 have accordingly been met.

TVA has also reviewed the NRC examples of licensing amendments considered not likely to involve significant hazards considerations as provided in the final adoption of 10 CFR 50.92 published on page 7751 of the Federal Register, Volume 51, No. 44, March 6, 1986. Example (X) provides four criteria that, if satisfied by a reracking request, indicate that it is likely no significant hazards considerations are involved. The criteria and how TVA's amendment request for WBN complies are indicated below.

Criterion (1):

The storage expansion method consists of either replacing existing racks with a design that allows closer spacing between stored spent fuel assemblies or replacing additional racks of the original design on the pool floor if space permits.

Proposed Amendment:

The WBN reracking involves replacing the existing racks with a design that allows slightly closer spacing between stored fuel assemblies and also provides additional rack storage on the pool floor where space permits.

Criterion (2):

The storage expansion method does not involve rod consolidation or double tiering.

Proposed Amendment:

The WBN racks are not double tiered, and the racks will sit on the floor of the spent fuel pool. Additionally, the amendment application does not involve consolidation of spent fuel.

Criterion (3):

The k_{eff} of the pool is maintained less than or equal to 0.95.

Proposed Amendment:

The design of the spent fuel racks contains a neutron absorber, Boral, to allow close storage of spent fuel assemblies while ensuring that the k_{eff} remains less than 0.95 under normal operating conditions with unborated water in the pool and less than 0.95 under abnormal conditions with soluble boron in the pool.

Criterion (4):

No new technology or unproven technology is utilized in either the construction process or the analytical techniques necessary to justify the expansion.

Proposed Amendment:

The construction processes and analytical techniques used in the fabrication and design are substantially the same as those of numerous other rack installations. Thus, no new or unproven technology is utilized in the construction or analysis of the high-density, spent fuel racks at WBN. TVA's contractor, Holtec International, has previously supplied licensable racks of very similar design for about 10 other reracking projects.

REFERENCES

1. Section 5.5, 6.5, 7.2, 7.3, and 9.1 of Enclosure 2 to TVA's letter to NRC dated October 23, 1996 "Watts Bar Nuclear Plant (WBN) Unit 1 - Request for License Amendment to Technical Specifications (TS) - Spent Fuel Pool Storage Capacity Increase" (WBN-TS-96-010).

2. Response to Comments 1 and 5 of NRC's letter dated February 12, 1997 "Request Regarding No Significant Hazards Determination for the Watts Bar Nuclear Plant, Unit 1 Spent Fuel Pool Reracking and Enrichment Increase (TAC No. M96930)"

3. Response to Question No. 5 in TVA's letter to NRC dated February 10, 1997 "Watts Bar Nuclear Plant (WBN) Unit 1 - Response to Request for Additional Information Regarding Request for License Amendment to Technical Specifications - Spent Fuel Pool Storage Capacity Increase (TAC No. M96930)"

4. Section 2.3 of Enclosure 2 to TVA's letter to NRC dated October 23, 1996 "Watts Bar Nuclear Plant (WBN) Unit 1 - Request for License Amendment to Technical Specifications (TS) - Spent Fuel Pool Storage Capacity Increase" (WBN-TS-96-010)

5. Response to Question No. 4 in TVA's letter to NRC dated February 24, 1997 "Response to Request for Additional Information Regarding Request for License Amendment to Technical Specifications - Spent Fuel Pool Storage Capacity Increase (TAC No. M96930)"

6. Chapter 7 of Enclosure 2 to TVA's letter to NRC dated October 23, 1996 "Watts Bar Nuclear Plant (WBN) Unit 1 - Request for License Amendment to Technical Specifications (TS) - Spent Fuel Pool Storage Capacity Increase" (WBN-TS-96-010).

7. Chapter 6 of Enclosure 2 to TVA's letter to NRC dated October 23, 1996 "Watts Bar Nuclear Plant (WBN) Unit 1 - Request for License Amendment to Technical Specifications (TS) - Spent Fuel Pool Storage Capacity Increase" (WBN-TS-96-010).