UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NO. 15 TO FACILITY OPERATING LICENSE NO. NPF-90

TENNESSEE VALLEY AUTHORITY

WATTS BAR NUCLEAR PLANT, UNIT 1

DOCKET NO. 50-390

1.0 INTRODUCTION

By letters dated May 6, and June 5, 1998, the Tennessee Valley Authority (TVA or the licensee) submitted a request for changes to the Watts Bar Nuclear Plant, Unit 1 (WBN), Technical Specifications (TS). The requested changes would allow an increased limit for the U-235 enrichment of new (unirradiated) fuel assemblies stored in the new fuel storage racks. The proposed changes would allow for the storage of fuel assemblies with a maximum nominal enrichment of 5.0 weight percent (w/o) U-235, with a tolerance of up to +0.05 w/o for individual fuel pins within the fuel assemblies, in the new fuel storage racks. The staff has previously approved the storage of fuel assemblies with maximum enrichments of 5.0 w/o U-235 in the WBN spent fuel storage racks in Amendment No. 6 to the Facility Operating License on July 28, 1997. Plant operation using the higher enriched fuel will be demonstrated to be acceptable by the cycle specific reload safety evaluation performed prior to each fuel loading. The staff's evaluation of the criticality aspects of the proposed changes follows.

The supplemental letter of June 5, 1998 included clarifying information and does not affect the staff's original no significant hazards consideration determination.

2.0 EVALUATION

The analysis of the reactivity effects of fuel storage in the new fuel storage racks was performed with the NITAWL, XSDRNPM, and KENO IV methodology using the 227 energy group neutron cross section library generated from ENDF/B-V data. The analytical methods and models used in the reactivity analysis are widely used for the analysis of fuel rack reactivity and have been benchmarked against results from numerous critical experiments. These experiments simulate the WBN storage racks as realistically as possible with respect to parameters important to reactivity such as enrichment, assembly spacing, and moderator properties. The U.S. Nuclear Regulatory Commission (NRC) has concluded that the analysis methods used are acceptable and capable of predicting the reactivity of the WBN new fuel storage rack with a high degree of confidence.

Fresh fuel is normally stored dry in the new fuel racks. However, to meet the criteria stated in Section 9.1.1 of the NRC Standard Review Plan (SRP), k_{eff} must not exceed 0.95 with the racks fully loaded with fuel of the highest anticipated reactivity and flooded with unborated water.

Enclosure

Furthermore, k_{eff} must be no greater than 0.98 under low density (optimum moderation) conditions. The maximum calculated reactivity must include a margin for uncertainties in reactivity calculations and in manufacturing tolerances such that the true k_{eff} will not exceed these limits at a 95% probability, 95% confidence (95/95) level.

The fuel assembly parameters used in the criticality analysis are based on the Westinghouse 17x17 Standard (STD) fuel assembly design. The reactivity of the STD design is either equivalent to, or bounds, the Westinghouse VANTAGE-5H and the Performance Plus assembly types which are also present at WBN. All fuel rods were assumed to contain UO_2 at a maximum enrichment of 5.05 w/o U-235 over their entire length to conservatively account for a ±0.05 w/o enrichment variability. No credit was taken for any natural enrichment axial blankets, fission product buildup, spacer grids or spacer sleeves, or burnable absorbers. These are conservative assumptions and are acceptable.

For the full density moderation analysis, the moderator was assumed to be pure water at a density of 1.0 gm/cc (20°C). Current industry practice is to perform this analysis at 4°C rather than 20°C, since this has been proven to be an achievable temperature in storage areas. Although the lower temperature results in a more reactive configuration for fully flooded and poisoned spent fuel storage configurations, it is not significant for fresh fuel storage arrays where optimum moderation occurs at water densities much lower than 1.0 gm/cc, as shown below, and thus would occur at higher temperatures. Therefore, this temperature effect does not impact the validity of the current analysis. The calculated k_{eff} included a method bias determined from benchmark critical comparisons, a 95/95 uncertainty in the method bias, and 95/95 uncertainties arising from consideration of mechanical and material thickness tolerances. The maximum calculated k_{eff} was 0.9338. Since k_{eff} is less than 0.95, including uncertainties at a 95/95 probability/confidence level, the staff's acceptance criterion for precluding criticality is met under full density water flooding conditions for storage of Westinghouse 17x17 STD, VANTAGE-5H, or Performance Plus fuel assemblies with nominal enrichments up to 5.0 w/o U-235.

For the low density, optimum moderation analysis, a fully loaded rack of fuel assemblies with nominal enrichments greater than 4.30 w/o U-235 resulted in a k_{eff} greater than 0.98. Therefore, a restriction had to be placed on the storage configuration for assemblies with nominal enrichments greater than 4.30 w/o U-235 in order to meet the required subcriticality margin. Only 120 specific cells of the 130 available storage locations were utilized as shown in TS Figure 4.3-2. Figure 4.3-2 has been added to the TS to indicate the 10 cells required to be vacant. In a letter from P. L. Pace to the NRC, dated June 5, 1998, TVA provided a commitment to require an insert holder plate in each of the restricted cells, when fuel assemblies above 4.3 w/o U-235 are to be received, and to require that these plates remain in place during fuel handling operations as a reminder to the fuel handling people that the cells are restricted. The NRC staff finds that reasonable controls for the implementation and for subsequent evaluation of proposed changes pertaining to this regulatory commitment are best provided by the licensee's administrative processes, including its commitment management program. The above regulatory commitments do not warrant the creation of regulatory requirements (items requiring prior NRC approval of subsequent changes). The staff notes that pending industry and regulatory guidance pertaining to 10 CFR 50.71(e) may call for some

information related to the above commitments to be included in a future update of the facility's Final Safety Analysis Report.

A method bias determined from benchmark critical experiments, as well as appropriate 95/95 uncertainties, were included for the low density, optimum moderation analysis. The analysis shows that for 5.05 w/o fuel, the maximum k_{eff} under low density moderation conditions of 0.9341 occurs at 0.07 gm/cc water density. Since k_{eff} is less than 0.98, including uncertainties at a 95/95 probability/confidence level, the staff's acceptance criterion for precluding criticality under low density, optimum moderation conditions, is met.

The following TS changes have been proposed as a result of the requested enrichment increase. The staff finds these changes, as well as the proposed additional administrative changes, acceptable.

> TS 4.3.1.2.a has been revised to increase the new fuel (fresh fuel) rack U-235 fuel assembly enrichment limit to 5.0 weight percent and to include a new Figure 4.3-2, which shows the required physical configuration of stored fuel assemblies.

3.0 SUMMARY

Based on the review described above, the NRC staff finds the criticality aspects of the proposed enrichment increase to the WBN new fuel storage racks are acceptable and meet the requirements of General Design Criterion 62 for the prevention of criticality in fuel storage and handling. Therefore, the proposed TS changes are acceptable. In order to meet the required subcriticality margin, a limitation had to be placed on the storage configuration. Only 120 specific cells of the 130 available storage locations were utilized as shown in TS Figure 4.3-2. TVA has committed to installation of insert holder plates in the cell locations required to be vacant to ensure that inadvertent loading of fuel into these locations will not occur.

Although the WBN TS have been modified to specify the above-mentioned fuel as acceptable for storage in the new fuel racks, evaluations of reload core designs (using any enrichment) will, of course, be performed on a cycle-by-cycle basis as part of the reload safety evaluation process. Each reload design is evaluated to confirm that the cycle core design adheres to the limits that exist in the accident analyses and TS to ensure that reactor operation is acceptable.

4.0 STATE CONSULTATION

In accordance with the Commission's regulations, the Tennessee State official was notified of the proposed issuance of the amendment. The State official had no comments.

5.0 ENVIRONMENTAL CONSIDERATION

Pursuant to 10 CFR 51.21, 51.32, and 51.35, an environmental assessment and finding of no significant impact has been prepared and published in the Federal Register on November 30, 1998 (63 FR 65816). Accordingly, based upon the environmental assessment, the staff has determined that the issuance of this amendment will not have a significant effect on the quality of the human environment.

6.0 CONCLUSION

The Commission has concluded, based on the considerations discussed above, that: (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, (2) such activities will be conducted in compliance with the Commission's regulations, and (3) the issuance of the amendment will not be inimical to the common defense and security or to the health and safety of the public.

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Date: December 1, 1998