



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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION  
RELATED TO AMENDMENT NO. 133 TO FACILITY OPERATING LICENSE NO. DPR-40  
OMAHA PUBLIC POWER DISTRICT  
FORT CALHOUN STATION, UNIT NO. 1  
DOCKET NO. 50-285

1.0 INTRODUCTION

By letters dated January 26, May 10, June 18, and August 2, 1990 (References 1, 4, 5 and 6), Omaha Public Power District (OPPD) requested changes to the Fort Calhoun Unit 1 Technical Specifications. The following changes are requested: (1) Increase the refueling boron concentration from 1800 to 1900 ppm; (2) Suspend certain sampling during periods when the fuel has been removed from the reactor vessel; (3) Revise the storage requirements of the spent fuel pool Region 2; (4) Allow discharge of fuel assemblies from the core directly to Region 2 of the spent fuel pool; and (5) Delete the requirements to provide a fuel performance report at the end of each cycle.

As a result of the staff's review, the licensee supplemented its initial application with supplemental submittals which the staff included in its original findings of no significant hazards consideration except for the August 2, 1990 submittal. This submittal corrected Technical Specification pages to include an omitted Greek letter  $\mu$  in its units. The August 2nd change was within the scope of the notice published in the Federal Register on July 25, 1990 (55 FR 30305), and did not affect the initial determination.

2.0 DISCUSSION

2.1 Refueling Boron Concentration

The proposed amendment would increase the reactor vessel refueling boron concentration from 1800 to 1900 ppm in Technical Specification Sections Definitions, 2.3, 2.8, 2.14 and 4.4. The limit on the boron concentration during refueling ensures that the reactor will remain subcritical by at least 5% delta k/k even if all control element assemblies (CEAs) are fully withdrawn from the core, as required by the plant Technical Specifications. In addition, the limit also provides 33.3 minutes before shutdown margin would be lost in the event of an inadvertent boron dilution assuming the maximum credible influx of unborated water. This meets the Fort Calhoun licensing basis requirement of a dilution time to critical of not less than 30 minutes during refueling. The shutdown margin and boron dilution events were calculated using approved methods. The proposed changes are, therefore, acceptable.

## 2.2 Suspend Certain Sampling When All Fuel is Removed

### 2.2.1 Suspension of Boron Sampling When All Fuel is Removed

The proposed amendment would allow the suspension of boron sampling in the reactor vessel when all fuel has been removed. Technical Specification Sections 2.8 and 3.2 are affected. The reactor vessel coolant boron concentration requirement is based on the need for adequate shutdown margin during refueling or fuel handling. When there is no fuel in the vessel, shutdown margin is not required and the need for boron is eliminated. Therefore, the need for sampling the boron concentration is eliminated. The elimination of boron sampling and analyses when the core has been off-loaded is adequately covered by Footnote (3) to Technical Specification Table 3-4, Minimum Frequencies for Sampling Test, which requires reinitiation of sampling on shift prior to reintroduction of fuel into the reactor cavity. In addition, the proposed deletion of Section (6) to Technical Specification 2.8 is acceptable as it is consistent with the frequency now required by Table 3-4. The proposed changes are, therefore, acceptable.

### 2.2.2 Suspension of Chloride Sampling When All Fuel is Removed

The proposed amendment would allow the suspension of chloride sampling in the reactor vessel when fuel is removed. Table 3-4 of Technical Specification 3.2 is affected. The chloride ion concentration limit is established to prevent any potential degradation of fuel mechanical design properties or Reactor Coolant System (RCS) piping. When fuel is not present, the mechanical design properties of the RCS are not subject to potential degradation due to intergranular stress corrosion cracking induced by a high chloride concentration. The licensee's chemical control procedure provides adequate assurance that chloride contamination is not likely. The sampling requirements of Technical Specification Table 3-4, Minimum Frequencies for Sampling Test, require reinitiation of sampling one shift prior to reintroduction of fuel into the reactor cavity. This provides for detection of chloride contamination and subsequent corrective action prior to reintroduction of fuel into the reactor. The proposed changes are, therefore, acceptable.

## 2.3 Storage Requirements for Spent Fuel Pool Region 2

The proposed amendment would modify Technical Specification Figure 2-10 to allow spent fuel assemblies stored in Region 1, which currently do not meet the minimum burnup requirements for storage in Region 2, to be moved to Region 2 if a full length CEA is inserted into the fuel assembly. The spent fuel storage racks consist of two distinct regions. Region 1 can accept either new or irradiated fuel. Region 2, however, can accept only spent fuel meeting the minimum exposure requirements currently specified in Figure 2-10.

Analyses were performed for the licensee by Pickard, Lowe and Garrick (PLG) to determine the reactivity of the spent fuel racks ( $k_{\text{eff}}$ ) as a function of initial U-235 enrichment and exposure. PLG has demonstrated their ability to calculate the reactivity of spent fuel pool racks in the past. The models and codes which have been used in the analyses have been thoroughly qualified by comparison with measured critical experiments and other published data. Therefore, the staff considers PLG and the methods used adequately qualified. The effects of calculational biases and uncertainties, manufacturing and mechanical tolerances, and postulated accidents have been adequately accounted for in the determination of the minimum allowable exposure, as a function of initial enrichment, for an assembly with a CEA in place to be moved to Region 2. In addition, the determination of the minimum amount of boron-10 (B-10) remaining in the CEAs assumed full CEA insertion during their residence in the core. This is conservative since the CEAs had only limited insertion during their exposure in the core.

The results of the analyses show that a  $k_{\text{eff}}$  of 0.9450 can be maintained in the Region 2 rack with CEAs inserted in fuel assemblies with an initial enrichment of 3.25 weight percent (w/o) U-235 after achieving an exposure of 4,900 MWD/MTU. Equivalently, for an initial enrichment of 4.00 w/o U-235, the required exposure is 12,800 MWD/MTU. This meets the NRC fuel storage criterion which specifies that the worst case  $k_{\text{eff}}$  for the storage rack, including all biases and uncertainties, must be no greater than 0.95.

The 45 CEAs currently residing in the spent fuel pool have been shown to have maintained their structural integrity by a combination of inspections and calculations. However, because of the recent CEA failures in older CE designs attributed to irradiation assisted stress corrosion cracking (IASCC), the licensee was asked to evaluate the continued acceptable use of these 45 CEAs for subcriticality during their lifetime in the spent fuel pool. The licensee stated that the relatively benign environment of the spent fuel pool, as compared to the reactor core, would not cause future IASCC. The staff, therefore, concludes that these CEAs are acceptable for use as neutron absorbers. Administrative controls will require the CEAs to remain in the fuel assemblies while they are resident in Region 2. In addition, a clip will be attached to tie the CEA and fuel assembly together in Region 1 prior to transfer to Region 2. The clip will not be able to be removed by the grapple on the fuel handling machine. This physical restraint system will prevent the inadvertent removal of a CEA from the fuel assembly after it is inserted. The staff concludes that the administrative controls and the physical restraints are sufficient to preclude the inadvertent removal of a CEA from a fuel assembly and thus maintain the required amount of subcriticality in the spent fuel pool. The proposed changes are, therefore, acceptable.

#### 2.4 Direct Transfer of Spent Fuel from Reactor Core to Region 2

The proposed amendment would modify Technical Specification Section 2.8 to allow spent fuel to be transferred directly from the reactor core to Region 2 of the spent fuel pool. Originally, the staff required fuel to be moved directly from the core to Region 1 and then to Region 2 only after proper verification had been made of sufficient burnup for acceptable storage in Region 2. An interlock on the fuel handling crane at Fort Calhoun prevented fuel from being transferred from the core directly to Region 2. Subsequently, the staff modified its requirements and allowed a by-pass of the interlock such that sufficiently irradiated fuel could be directly placed into Region 2 if two independent verifications of burnup adequacy were performed (Ref. 2). A fuel burnup determination is performed at Fort Calhoun prior to fuel movement into Region 2 of the spent fuel pool using Special Procedures SP-BURNUP-1. The staff concludes that this procedure adequately ensures that the fuel will meet the acceptance criteria for burnup prior to movement to Region 2. In addition, the potential risk of dropping a fuel assembly with the additional handling required in a two-step operation is minimized. The proposed change is, therefore, acceptable.

#### 2.5 End of Cycle Fuel Performance Report

The requested revision to Technical Specification Section 5.9.3.h would eliminate the requirement for a fuel performance report at the end of each cycle. This request is administrative because it has been previously approved in the Safety Evaluation Report for Amendment No. 77 (Ref. 3) but was inadvertently retained in the Technical Specifications. The reportable events required by 10 CFR 50.73 would still require the licensee to report unique, widespread or unexpected fuel cladding failures in the reactor or spent fuel pool.

#### 2.6 Findings

Based on the above evaluation, the staff finds that the requested changes to the Fort Calhoun Unit 1 Technical Specifications are acceptable.

#### 3.0 ENVIRONMENTAL CONSIDERATION

The amendment involves a change in a requirement with respect to the installation or use of a facility component located within the restricted area as defined in 10 CFR Part 20 and changes in surveillance requirements. The staff has determined that the amendment involves no significant increase in the amounts, and no significant change in the types, of any effluents that may be released offsite, and that there is no significant increase in individual or cumulative occupational radiation exposures. The Commission has previously issued a proposed finding that the amendment involves no significant hazards consideration and there has been no public comment on such finding. Accordingly, the amendment meets the eligibility criteria for categorical exclusion set forth in 10 CFR Section 51.22(c)(9). Pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment need be prepared in connection with the issuance of the amendment.

#### 4.0 CONCLUSION

The staff 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, and (2) such activities will be conducted in compliance with the Commission's regulations, and the issuance of the amendment will not be inimical to the common defense and security or to the health and safety of the public.

#### 5.0 REFERENCES

1. Letter from K.J. Morris (OPPD) to USNRC, "Application for Amendment of Operating License, LIC-89-1171," January 26, 1990.
2. Memorandum from Frederick J. Hebdon (NRC PD-IV) to James L. Milhoan (NRC Reg. IV), "Ft. Calhoun Spent Fuel Storage Procedures," July 19, 1989.
3. Letter from E.G. Tourigny (NRC) to W.C. Jones (OPPD), "Amendment No. 77 to Facility Operating License No. DPR-40 for the Fort Calhoun Station, Unit 1," April 26, 1984.
4. Letter from W.G. Gates (OPPD) to USNRC, "Application for Amendment of Operating License, LIC-90-0378," May 10, 1990.
5. Letter from W.G. Gates (OPPD) to USNRC, "Application for Amendment of Operating License, LIC-90-0500," June 18, 1990.
6. Letter from W.G. Gates (OPPD) to USNRC, "Application for Amendment of Operating License, LIC-90-0645," August 2, 1990.

Dated: October 12, 1990

#### Principal Contributors:

L. Kopp, SRXB  
S. Koscielny, EMCB