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UNION ELECTRIC

March 6, 1990

Donald F. Schnell
Senior Vice President
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Gentlemen: ULNRC- 2169

DOCKET NUMBER 50-483
CALLAWAY PLANT
ADDITIONAL INFORMATION REGARDING STORAGE
OF ENRICHED FUEL IN SPENT FUEL POOL AREA
(TAC NO. 75619)

Reference: ULNRC-2130, dated December 28, 1989
NRC Letter to D. F. Schnell, dated
February 16, 1990

Please find the attached Enclosure containing the responses to the referenced NRC Letter that requested additional information to assist the staff in its review of our amendment request (Union Electric Letter ULNRC-2130) regarding the storage of enriched fuel in the spent fuel pool area.

If there are additional questions concerning this matter, please contact Mr. D. E. Shafer of my staff.

Yours very truly,

Donald F. Schnell

Donald F. Schnell

DJW/kea

Enclosure



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STATE OF MISSOURI )
) S S
CITY OF ST. LOUIS )

Donald F. Schnell, of lawful age, being first duly sworn upon oath says that he is Senior Vice President-Nuclear and an officer of Union Electric Company; that he has read the foregoing document and knows the content thereof; that he has executed the same for and on behalf of said company with full power and authority to do so; and that the facts therein stated are true and correct to the best of his knowledge, information and belief.

By Donald F. Schnell
Donald F. Schnell
Senior Vice President
Nuclear

SUBSCRIBED and sworn to before me this sixth day of March, 1989 90

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# ADDITIONAL INFORMATION
# CALLAWAY PLANT
# FUEL ENRICHMENT INCREASE AND STORAGE IN SPENT FUEL POOL

## NRC ITEM 1

Your analysis implies that the maximum reactivity occurs at zero burnup for any number of IFBA rods per assembly. If this is so, explain why and discuss how this has been verified by calculations.

## UNION ELECTRIC RESPONSE

Fuel assembly depletion calculations performed in PHOENIX show that for the number of IFBA rods per assembly considered in the Callaway analysis, the maximum reactivity for rack geometry occurs at zero burnup. Although the boron concentration in the IFBA rods decreases with fuel depletion, the fuel assembly reactivity decreases more rapidly, resulting in a maximum fuel rack reactivity at zero burnup.

## NRC ITEM 2

What fuel geometry was used for k-infinity calculations? This should be described in the FSAR.

## UNION ELECTRIC RESPONSE

The maximum fuel assembly k-infinity referenced in proposed Specification 5.6.1.1.c is based upon the core geometry. The proposed Specification will be revised to indicate this (see Attachment 1).

## NRC ITEM 3

Can the distribution of IFBA rods vary between assemblies as compared to the distribution assumed in the analysis? For example, can one assembly with 30 IFBA rods have a different IFBA rod pattern than another assembly with 30 IFBA rods? If so, what effect does this have on the rack reactivity results?

UNION ELECTRIC RESPONSE

The IFBA rod distributions used in the analysis assume use of the standard Westinghouse IFBA loading patterns, which are 32, 48, 64, 80, 100, 128 and 160 rods per assembly, in a prescribed pattern. Due to the nature of the IFBA rods, the rods can be placed in any configuration, however this is typically not done and would only be needed for very specialized conditions. In the event that a non-standard configuration would be utilized, a k-infinity calculation for that assembly would be performed to assure compliance with the Technical Specifications. A note will also be added to the FSAR table and curve which states that the data provided assumes use of the standard Westinghouse IFBA loading patterns.

NRC ITEM 4

Discuss the effect of the enrichment increase on postulated reactivity accidents in the pool. Is a minimum boron concentration assumed for accidents? If so, this should be a TS requirement with a corresponding surveillance requirement for periodic sampling.

UNION ELECTRIC RESPONSE

Most accident conditions will not result in an increase in Keff of the rack. Examples are the loss of cooling systems (reactivity decreases with decreasing water density) and dropping a fuel assembly on top of the rack (the rack structure pertinent for criticality is not excessively deformed and the dropped assembly has more than twelve inches of water separating it from the active fuel height of stored assemblies which precludes interaction).

However, accidents can be postulated which would increase reactivity (i.e., misloading the spent fuel pool region 2 with an assembly with an enrichment and IFBA combination outside of the acceptable combination, or dropping a fuel assembly between the rack and pool wall). For these accident conditions, the double contingency principle of ANSI N16.1-1975 is applied. This states that one is not required to assume two unlikely, independent, concurrent events to ensure protection against a criticality accident. Thus, for accident conditions, the presence of soluble boron in the storage pool water can be assumed as a realistic initial condition since not assuming its presence would be a second unlikely event.

Criticality Analyses demonstrate that the presence of approximately 2000 ppm boron in the pool water will decrease reactivity by about 30 percent ΔK. Thus, for postulated accidents, should there be a reactivity increase, Keff would be less than or equal to 0.95 due to the effect of the dissolved boron.

The presence of 2000 ppm boron is only a Technical Specification requirement at Callaway while in Mode 6 and is verified at intervals of 72 hours. At all other times the boron concentration is verified to be greater than or equal to 2000 ppm via the performance of administrative procedure, CDP-ZZ-00200, Chemistry Schedule and Water Specs. This surveillance is performed once per week. We believe that this administrative control is adequate to prevent criticality in the event of a mis-placed or mis-handled fuel assembly.

NRC ITEM 5

The statement is made that the equivalent k-eff for the storage of spent fuel in the Region I fuel racks is determined by modeling two-out-of-four storage locations. We also understand that a three-out-of-four storage restriction is required for Region II storage. Therefore, please modify TS section 5.6.1.1 to include these restrictions.

UNION ELECTRIC RESPONSE

Callaway FSAR Sections 9.1A.1.1 and 9.1A.1.2 describe the maximum density rack (MDR) design and the designations of Region 1 and 2 of the spent fuel pool. FSAR Figure 9.1A-1 describes the differences between Regions 1 and 2 of the spent fuel pool. Region 1 has fuel assemblies stored in two out of four box positions in a checkerboard pattern. This checkerboard pattern is maintained by the use of physical covers over the water box locations. These covers prohibit insertion of an assembly, but do not restrict water flow. Region 2 of the spent fuel pool has fuel assemblies stored in three out of four box positions. Again, Region 2 water boxes are physically covered. During a normal refueling operation, each fuel assembly is first moved from the core to Region I of the pool. Based upon the requirements of Technical Specification 3.9.12 and Technical Specification Figure 3.9-1, and Technical Specification Section 5.6.1.1, the fuel assembly is evaluated for suitability for storage in Region 2 of the pool. Suitability is based upon the combination of the assembly initial enrichment and its cumulative exposure; and whether the combination is within the acceptable domain of Technical Specification Figure 3.9-1. After the refueling operation is complete and the suitability of each fuel assembly for movement into Region 2 is verified, the fuel assembly may be moved into Region 2 of the spent fuel pool.

We believe the restrictions contained in Technical Specification 3.9.12 preclude the need to modify Section 5.6.1.1.

Attachment 1



## 5.6 FUEL STORAGE

### CRITICALITY

5.6.1.1 The spent fuel storage racks are designed and shall be maintained with:

a. A $k_{eff}$ equivalent to less than or equal to 0.95 when flooded with unborated water, which includes ~~a conservative~~ an allowance ~~of 0.01 Δk~~ for uncertainties as described in Section ~~4.3~~ 9.1A of the FSAR. This is based on ~~new~~ fresh fuel with ~~an enrichment of 4.25 weight percent~~ the maximum initial enrichment of U-235 in Region 1 and on spent fuel with combination of initial enrichment and discharge exposures, shown in Figure 3.9-1, in Region 2, and

b. A nominal 9.24 inch center-to-center distance between fuel assemblies placed in the storage racks, and

c. A maximum reference core geometry fuel assembly K∞ less than or equal to 1.455 at 68 °F for storage in Region 1.

5.6.1.2 The $k_{eff}$ for new fuel for the first core loading stored dry in the spent fuel storage racks shall not exceed 0.98 when aqueous foam moderation is assumed.

### DRAINAGE

5.6.2 The spent fuel storage pool is designed and shall be maintained to prevent inadvertent draining of the pool below elevation 2040 feet.

### CAPACITY

5.6.3 The spent fuel storage pool is designed and shall be maintained with a storage capacity limited to no more than 1344 fuel assemblies.

## 5.7 COMPONENT CYCLIC OR TRANSIENT LIMIT

5.7.1 The components identified in Table 5.7-1 are designed and shall be maintained within the cyclic or transient limits of Table 5.7-1.