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U. S. Nuclear Regulatory Commission
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Subject: Arkansas Nuclear One - Units 1 and 2
Docket Nos. 50-313 and 50-368
License Nos. DPR-51 and NPF-6
120 Day Response to Generic Letter 96-04, Boraflex Degradation in Spent Fuel Pool Storage Racks

Gentlemen:

Generic Letter 96-04, "Boraflex Degradation in Spent Fuel Pool Storage Racks," dated June 28, 1996 (0CNA069618), requested licensees that use Boraflex absorber in their spent fuel storage racks to assess the capability of the Boraflex to maintain a 5 percent subcriticality margin and submit a plan describing proposed actions if this subcriticality margin cannot be maintained by the Boraflex material because of current or projected future Boraflex degradation. The information requested within 120 days is provided in the attachment.

Should you have any questions, please contact me.

A068 1/1

Very truly yours,

Dwight C. Mims

Dwight C. Mims
Director, Nuclear Safety

DCM/nbm
Attachment

To the best of my knowledge and belief, the statements contained in this submittal are true.

SUBSCRIBED AND SWORN TO before me, a Notary Public in and for Logan **County and the State of Arkansas, this** 24th **day of** October**, 1996.**

Sandy Siebenmorgen
Notary Public
My Commission Expires May 11, 2000

cc: Mr. Leonard J. Callan
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Generic Letter 96-04 Request

Licensees of power reactors with installed spent fuel storage racks containing the neutron absorber Boraflex are requested to provide an assessment of the physical condition of the Boraflex, including any deterioration, on the basis of current accumulated gamma exposure and possible water ingress to the Boraflex and state whether a subcritical margin of 5 percent can be maintained for the racks in unborated water. Monitoring programs or calculational models in effect or being developed, or an estimation of anticipated concerns based on the specific rack design, are considered an appropriate basis for this response. Licensees are further requested to submit a description of any proposed actions to monitor or confirm that this 5 percent subcriticality margin can be maintained for the lifetime of the storage racks and describe what corrective actions could be taken in the event it cannot be maintained. Licensees should state whether blackness testing, or other in-situ test or measurements, will be periodically performed. Chronological trends of pool reactive silica levels, along with the timing of significant events such as refuelings, pool silica cleanups, etc., should be provided. Implications of how these pool silica levels relate to Boraflex performance should be described. Licensees are also requested to submit the information to ensure that the onsite storage of spent fuel is in compliance with GDC 62 for the prevention of criticality in fuel storage and handling with the 5 percent subcriticality margin.

Background

The Arkansas Nuclear One (ANO) Units 1 and 2 spent fuel pool storage racks use Boraflex as a neutron absorber. Both units have two fuel storage regions. Region 1 uses Boraflex as a poison to allow storage of high reactivity assemblies. Storage in Region 2 is restricted to assemblies which meet burnup requirements. The racks at both units were installed in the spring of 1984.

The spent fuel storage racks at ANO-1 and ANO-2 are similar Westinghouse designs. Each cell is composed of a stainless steel box with Boraflex panels on each side retained by a stainless steel wrapper plate. The ANO-1 wrapper plate is approximately 139 inches long and is spot welded in twenty locations on seven inch centers. The ANO-2 wrapper plate is approximately 144 inches long and is spot welded in approximately fifteen locations on ten inch centers. These configurations form a stable and relatively "tight" configuration that minimize the potential for water ingress.

Existing Monitoring Program

During the initial licensing of the ANO spent fuel storage racks, a program to monitor Boraflex behavior was implemented which utilizes coupon specimens. These coupon specimens are periodically removed and inspected. The inspections provide an indication of the general condition of the Boraflex, including gross or unusual degradation. Long term and accelerated test location coupons are utilized. Long term coupons are tested approximately every five years while accelerated coupons are tested after each refueling. The coupons are sent off site to an independent laboratory for testing.

Surveillance Coupon Results

Recent surveillance coupons from both spent fuel pools have exhibited cracks due to brittleness. A gray powder was present on the edges, which were not well defined, as expected. The neutron attenuation measurements of the coupons at both units correspond to a Boron-10 areal density greater than their respective minimum design values.

Spent Fuel Pool Dose Levels

Preliminary calculations of the Boraflex panel doses in the racks have been performed. The estimated average dose to the bulk of the irradiated panels is approximately 8 x 10^9 Rads for the ANO-1 racks and 7 x 10^9 Rads for the ANO-2 racks. The Electric Power Research Institute (EPRI) has established that insignificant Boraflex dissolution occurs below threshold doses of 2 to 3 x 10^9 Rads. The bulk of the ANO spent fuel storage cells have achieved this dose.

Trend of Pool Silica Concentrations

The available silica data is provided in Figures 1 and 2. Reductions in the silica concentration can be observed during outages as expected. No silica cleanup campaigns have been conducted at ANO. The silica levels are consistent with levels at other PWR racks reported at the recent EPRI Boraflex workshop. The trends are inconclusive, but the silica levels indicate that some degradation due to water ingress may be occurring. The extent of this effect depends on detailed evaluation of the fuel pool design and operation. EPRI has developed the RACKLIFE computer modeling system to perform this evaluation. An initial application has been successfully performed at another site. Model enhancements are currently being incorporated into the system based on initial utility use. Efforts to develop a RACKLIFE model to perform silica evaluations for the ANO-1 and ANO-2 spent fuel pools are currently in progress.

Criticality Analysis Assessment

The ANO spent fuel pool rack criticality analyses assume the minimum design Boron-10 loading which is typically 10% less than the as-built loading. The storage racks at both units allow storage of assemblies with enrichments up to 4.1 weight percent U-235 without credit for fuel assembly integral poisons.

A revised ANO-2 spent fuel pool rack criticality analysis supporting a technical specification enrichment increase has been submitted to the NRC for review. In this analysis, a 4 x 4 array of storage rack cells is modeled to allow the consideration of realistic Boraflex panel shrinkage configurations. This analysis conservatively assumes shrinkage occurs at the upper and lower panel ends which was determined to be the most reactive location for the ANO-2 racks. All panels were assumed to have shrinkage at the upper and lower edges with distribution based on EPRI data reported for Westinghouse racks. The minimum design Boron-10 loading was assumed, the panel width was reduced by 4.1%, and the maximum shrinkage was determined by EPRI data. In order to support storage of assemblies with enrichments up to 5.0 weight percent U-235 with no credit for fuel assembly integral poisons in Region 1, a three-of-four checkerboard configuration has been proposed. Burnup criteria determine what assemblies do not require restricted storage in Region 1. The analysis determined a maximum 95/95 eigenvalue of 0.942 which is well below the acceptance

criterion. This result provides an allowance for approximately 20% reduction from the minimum design Boron-10 loading due to water ingress.

Preliminary calculations have been performed in support of a future technical specification enrichment increase for ANO-1. These calculations used panel gap/end shrinkage based on EPRI data for Westinghouse racks. These calculations confirmed the 5 percent subcriticality margin is maintained.

The potential effects of Boraflex panel slumping which have been postulated to occur following a seismic event are more than offset by the presence of soluble boron in the spent fuel pool.

In conclusion, the storage of spent fuel at ANO-1 and ANO-2 meets the required 5-percent subcriticality margin in unborated water and is in compliance with GDC 62 for the prevention of criticality in fuel storage and handling.

Monitoring Program Revisions

In order to ensure that the 5 percent subcriticality margin can be maintained for the life of the spent fuel storage racks, ANO will continue the existing coupon monitoring program with the following revisions:

- ANO-1 and ANO-2 will continue to monitor spent fuel pool silica levels and perform silica evaluations. These evaluations will be based on the EPRI RACKLIFE system or its equivalent. Projected Boraflex performance will be assessed to confirm the 5 percent subcriticality margin will be maintained through the next evaluation period. These initial assessments will be completed in approximately one year and continue each cycle prior to fuel receipt.

- In the event this assessment determines the 5 percent subcriticality margin cannot be maintained, immediate steps will be taken to maintain soluble boron levels to insure this margin is sustained. Additionally, analyses could be performed to justify continued use of the racks in unborated water based on more realistic assumptions such as credit for integral poisons, higher burnup requirements, or additional restrictions on fuel storage configurations.

- ANO-1 plans to complete a revised criticality analysis for the spent fuel storage racks. This analysis will include Boraflex shrinkage assumptions and an allowance for degradation due to water ingress. This analysis is planned for submittal and NRC approval prior to Cycle 15 fuel receipt.

Additionally, alternatives exist to maintain use of the racks if the monitoring program indicates margin may not be maintained at some future date. These alternatives include, but are not limited to, credit for higher burnup, alternate rack loading plans, and the use of neutron absorbing inserts. The Region 2 spacer-pocket rack design at both units would allow a portion of these racks to be converted to allow storage of high reactivity assemblies. Also, credit for soluble boron in the spent fuel pool could be utilized if this alternative becomes available at a future date.

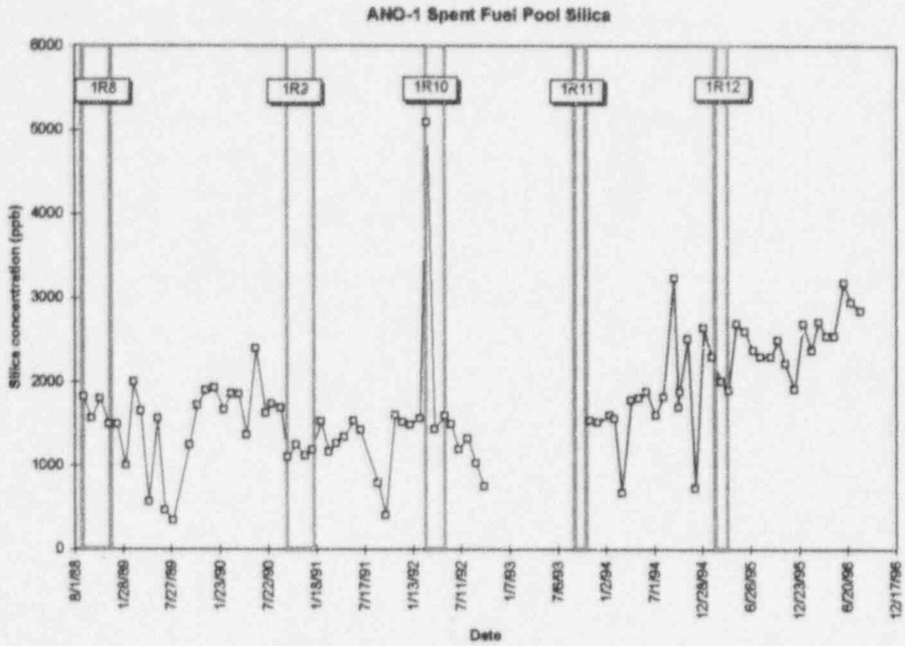

Figure 1. ANO Unit 1 Spent Fuel Pool Silica Data

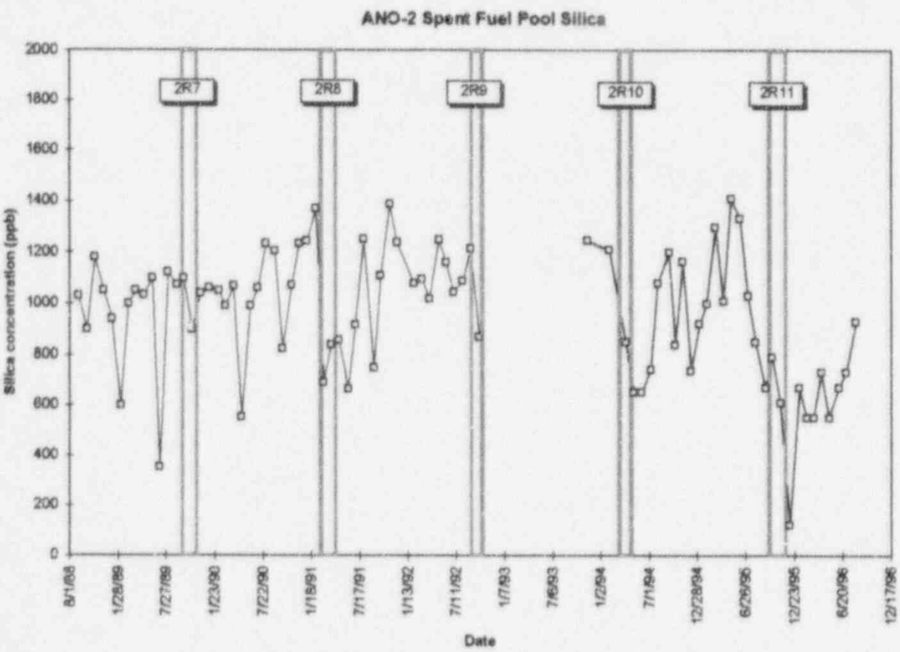

Figure 2. ANO Unit 2 Spent Fuel Pool Silica Data