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U. S. Nuclear Regulatory Commission
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Subject: River Bend Station - Unit 1
Docket No. 50-458
License No. NPF-47
Response to Generic Letter 96-04

File Nos.: G9.5, G9.42

RBG-43325
RBF1-96-0386

Gentlemen:

Pursuant to Generic Letter 96-04, "Boraflex Degradation In Spent Fuel Pool Storage Racks," River Bend Station is submitting the 120 day required response (Attachment 2). The Generic Letter requested all licensees that use Boraflex as a neutron absorber in their spent fuel pool racks to (1) assess the capability of the Boraflex to maintain a 5-percent subcriticality margin and (2) submit a plan describing proposed actions in the event this margin cannot be maintained by the Boraflex material because of current or projected Boraflex degradation.

This letter is submitted under oath under the provisions of Section 182a, Atomic Energy Act of 1954, as amended, and 10 CFR 50.54(f). If additional information is needed, please contact Tim Gates at (504) 381-4866.

Yours truly,

RJK/TWG/MKB

enclosures: 1. Affirmation per 10 CFR 50.54(f)
2. Requested Information

A0681/1

cc: Mr. David L. Wigginton
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ENCLOSURE 1

BEFORE THE
UNITED STATES NUCLEAR REGULATORY COMMISSION

LICENSE NO. NPF-47

DOCKET NO. 50-458

IN THE MATTER OF
ENTERGY GULF STATES, INC
CAJUN ELECTRIC POWER COOPERATIVE AND
ENTERGY OPERATIONS, INC.

AFFIRMATION

I, Rick J. King, state that I am Director - Nuclear Safety & Regulatory Affairs of Entergy Operations, Inc., at River Bend Station; that on behalf of Entergy Operations, Inc., I am authorized by Entergy Operations, Inc., to sign and file with the Nuclear Regulatory Commission, this response to Generic Letter 96-04, that I signed this letter as Director - Nuclear Safety & Regulatory Affairs at River Bend Station of Entergy Operations, Inc.; and that the statements made and the matters set forth therein are true and correct to the best of my knowledge, information, and belief.

Rick J. King

STATE OF LOUISIANA
PARISH OF WEST FELICIANA

SUBSCRIBED AND SWORN TO before me, a Notary Public commissioned in East Baton Rouge Parish and qualified for the Parish and State above named, this 24th day of October, 1996.

(SEAL)

Jane Russell
Notary Public

My commission expires with life

Background

The River Bend Station spent fuel storage racks use Boraflex as a neutron absorber. These racks were installed prior to initial fuel receipt in 1985, and were exposed to irradiated fuel during the initial refueling outage (September 1987).

The racks are a Westinghouse design. This design uses a checkerboard of cell enclosures to assemble each fuel storage array. A Boraflex sheet, encapsulated by a wrapper plate, is welded to each internal enclosure wall. Peripheral faces of each array are left unpoisoned. Wrapper plates are tabbed top and bottom, and include side flanges that sit flush with the enclosure wall. A total of 24 spot welds, spaced approximately every seven inches along each flange, are used to affix the wrapper plates to the enclosure. Because the wrapper plates are not subject to structural stresses, this configuration provides a stable and relatively "tight" configuration that minimizes the potential for water ingress.

Existing Monitoring Program

During the initial licensing of the River Bend racks a program to monitor Boraflex behavior was proposed based on coupon specimens. As implemented, the program provides for coupon inspections which are designed to indicate the general condition of the Boraflex and reveal gross or unusual degradation. Long term surveillance coupons were surrounded by spent fuel assemblies in RFO1. Both coupons and surrounding fuel have been left in place since that time, with the exception of temporary removal of the coupon hanger to acquire coupons for examination. Long term surveillance coupons are evaluated approximately every five years. Accelerated dose surveillance coupons are moved each reload so that they are continually surrounded by freshly discharged fuel. Accelerated dose surveillance coupons are removed for evaluation prior to each refueling outage.

After preliminary characterization at River Bend, the coupons may be sent off site to an independent laboratory for neutron attenuation and density testing.

Surveillance Coupon Results

The most recent surveillance coupons were evaluated in July, 1996. Three coupons were removed from the accelerated dose hanger.

Visual examination of all three coupons showed minor deterioration of the surface, but no appreciable amount of material missing. Two specimens were identified as having minor cracking, the third had more cracking than the other two coupons and minor pieces missing.

Off-site characterization of coupon samples revealed densities in the range 2.00 to 2.25 g/cc, suggesting that the samples had received doses in the range 2 - 3×10^{10} Rad. Neutron attenuation measurements found B-10 areal densities from 0.023 to 0.025 g/cm^2, indicating no significant decrease in B-10 areal density.

Results of BADGER Testing at Peach Bottom 2

The River Bend HDFR design is closely approximated by the Westinghouse racks in use at Peach Bottom Unit 2. An evaluation of Boraflex conditions in selected panels at Peach Bottom was performed in April 1996, using the BADGER system. BADGER is an EPRI developed system for evaluation of B-10 areal density using an in-situ neutron attenuation measurement.

Irradiated panels with accumulated dose ranging from 1.3×10^9 to 4.3×10^9 Rad were evaluated. This dose range compares favorably with the dose accumulated by the majority of irradiated panels at River Bend, as described below. As-built B-10 areal density data provided a base range for comparison to measured values. Reference values were approximated by evaluating two unirradiated panels.

Average measured B-10 areal densities were comparable to the as-built values, indicating no appreciable B-10 loss. Gaps were detected in most panels as expected. Most of these gaps are less than 1 inch, the largest gap detected is 3.4 inches in extent.

Spent Fuel Pool Dose Levels

Dose estimations for River Bend racks have been performed based on a preliminary model. This evaluation considers dose accumulated through October 1, 1996. Calculations were performed using methods consistent with those used at Peach Bottom. The results indicate the lead panel dose is approximately 6.3×10^9 Rad, and the average irradiated panel dose is 2.6×10^9 Rad.

EPRI has established that insignificant Boraflex dissolution occurs below threshold doses of 2×10^9 to 3×10^9 Rad. The bulk of the irradiated River Bend spent fuel storage cells have achieved this dose, therefore the potential for degradation due to water ingress exists.

Trend of Pool Silica Concentrations

The available Silica data is provided in Figure 1. Significant reductions in the Silica concentration can be observed during outages as expected. The Silica levels are consistent with levels at other BWR racks reported at the recent EPRI Boraflex workshop. The data indicate that some Silica release is occurring, but the cleanup system's removal of Silica limits the conclusions that can be drawn from the trends. The evaluation of the fuel pool design and operation with a detailed simulation is expected to provide a more conclusive assessment. RACKLIFE is the EPRI developed code intended for this purpose.

Criticality Analysis Assessment

The original River Bend Criticality analysis provides no allowance for Boraflex gapping. This analysis also does not take credit for the presence of the integral burnable absorber (Gadolinia) or for fuel depletion. Design minimum B–10 areal density is assumed for the Boraflex. Since as–fabricated B–10 loading is typically 10% higher than design minimum, some allowance is made for degradation due to water ingress. A revised criticality analysis has been completed and is undergoing licensing review. This revised analysis assumes credit for Gadolinia in a base fuel assembly with a 4.8 wt% U-235 enriched region. Each Boraflex panel is assumed to contain a 6 inch gap located within the central 50% of the panels length. All panels are also assumed to shrink 4.1% in width with no credit for densification. Additionally, the base B-10 areal density is assumed to be 90% of the design minimum B-10 loading to provide for potential degradation due to water ingress. Credit is not taken for as fabricated areal density, which typically contains 10% more B-10 than the design minimum.

The revised criticality analysis established that an infinite rack with this configuration had a k-effective, including uncertainties, below the 0.95 acceptance criteria. Therefore, a 5-percent subcriticality margin is maintained in unborated water.

The above information supports the conclusion that the Boraflex condition at River Bend racks is not degraded to the point where additional testing is required.

Monitoring Program Enhancements

In order to ensure that the 5 percent sub-criticality margin can be maintained for the life of the spent fuel storage racks the following enhancements to the River Bend Monitoring Program are proposed:

> River Bend will initiate a more comprehensive program to monitor spent fuel pool silica levels and perform silica evaluations. The initial evaluation will be completed prior to the next scheduled refueling outage (currently estimated to begin in October, 1997). Subsequent performances will occur prior to receipt of each new fuel batch. This evaluation will be based on the EPRI RACKLIFE system or its equivalent. Each evaluation will include projections to confirm acceptable performance through the next evaluation period.
>
> If silica evaluations indicate that the criticality analysis is not conservative, an analysis of the racks will be performed to confirm criticality margin can be maintained. During the interim period while this criticality confirmation is in progress, fuel loaded into the spent fuel pool will be restricted to a checkerboard configuration.

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, among others, credit for burnup beyond peak reactivity, alternate rack loading plans and the use of neutron absorbing inserts.

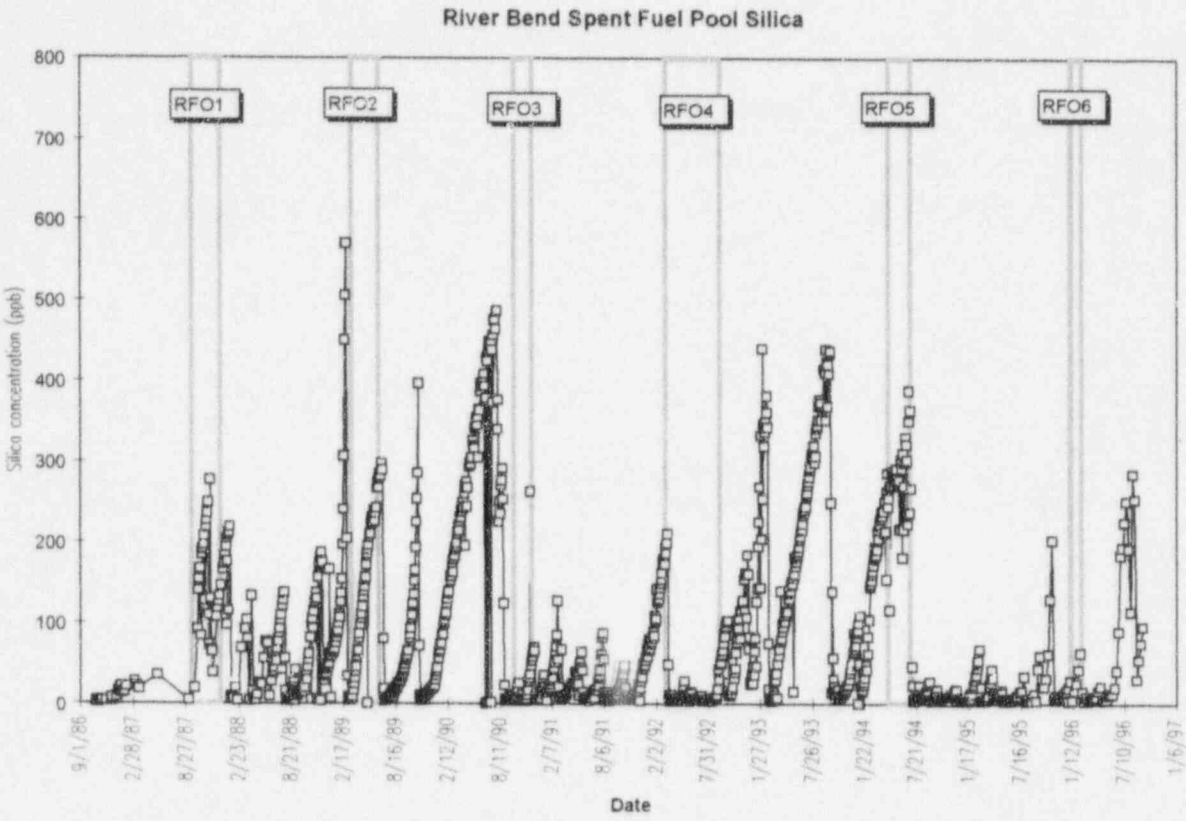

Figure 1: River Bend Spent Fuel Pool Silica Data