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Docket Nos.: 50-458/459

Mr. William J. Cahill, Jr.
Senior Vice President
River Bend Nuclear Group
Gulf States Utilities
P. O. Box 2951
Beaumont, Texas 70444
ATTN: Mr. J. E. Booker

Dear Mr. Cahill:

Subject: Resolution of LRG-II Channel Box Deflection Issue
(LRG-II Issue 3-CPB)

The Core Performance Branch of the NRC staff has prepared the enclosed staff position with regard to the channel box deflection issue for LRG-II plants. The staff position is provided for your information.

Sincerely,

Original signed by:

A. Schwencer, Chief
Licensing Branch No. 2
Division of Licensing

Enclosure:
As stated

cc: See next page

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SURNAME	RLPerch:kw	ASchwencer					
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River Bend

Mr. William J. Cahill, Jr.
Senior Vice President
River Bend Nuclear Group
Gulf States Utilities Company
Post Office Box 2951
Beaumont, Texas 77704
ATTN: Mr. J.E. Booker

cc: - Troy B. Conner, Jr., Esquire
Conner and Wetterhahn
1747 Pennsylvania Avenue, N. W.
Washington, D. C. 20006

Mr. William J. Reed, Jr.
Director - Nuclear Licensing
Gulf States Utilities Company
Post Office Box 2951
Beaumont, Texas 77704

Stanley Plettman, Esquire
Orgain, Bell and Tucker
Beaumont Savings Building
Beaumont, Texas 77701

William J. Guste, Jr., Esquire
Louisiana Attorney General
7434 Perkins Road
Baton Rouge, Louisiana 70808

Richard M. Troy, Jr., Esquire
Assistant Attorney General in Charge
State of Louisiana Department of Justice
234 Loyola Avenue
New Orleans, Louisiana 70112

Ross Brown
Resident Inspector
Post Office Box 1051
St. Francisville, Louisiana 70775

Gretchen R. Rothschild
Louisianians for Safe Energy, Inc.
1659 Glenmore Avenue
Baton Rouge, Louisiana 70808

James W. Pierce, Jr., Esq.
P. O. Box 23571
Baton Rouge, Louisiana 70893

Doris Falkenheiner, Esq.
Louisiana Consumers' League
535 North 6th Street
Baton Rouge, Louisiana 70802

Linda B. Watkins
Staff Attorney
Department of Justice
7434 Perkins Road
Suite C
Baton Rouge, Louisiana 70808

AUG 10 1981

Resolution of LRG-II Channel Box Deflection Issue (Issue 3-CFB)

BWR fuel channels provide structural stiffness for the fuel assemblies and distribute the coolant flow between the assemblies and channel bypass regions. The channels are subject to time-dependent, permanent dimensional changes (i.e., deflections) that result from irradiation, creep and stress-relaxation effects. The resultant bulge (resulting from long-term creep) or bow (resulting from differential irradiation-induced axial growth) reduces the size of the gap available for control rod insertion. Channel box deflection is thus a potential life-limiting phenomenon.

In a generic topical report (NEDE-21354) General Electric describes a channel lifetime prediction method and a backup recommendation for periodic channel deflection measurements that consist of settling friction tests. Upon consideration of the factors involved, the NRC staff concluded that the settling friction tests or an acceptable alternative (such as, channel dimensional deflection measurements) should be performed, and in a memorandum (L.S. Rubenstein to R. L. Tedesco) dated September 18, 1981, the staff outlined a method for resolving the channel box deflection issue for several near-term BWR operating license applications, which included LaSalle, Shoreham, Susquehanna, Zimmer, Fermi 2, Grand Gulf, Clinton, WNP-2, Perry and Riverbend. Basically, the staff accepted a multistep procedure that had been proposed by the Zimmer applicant. The key ingredient of the Zimmer plan was a commitment to: a) perform some control rod settling friction tests, which would provide an exact profile of control rod drive friction versus position at refueling outages, or b) make some actual channel dimensional measurements. Plants that agreed to the Zimmer proposal and for which we were able to close out the issue completely included: (in addition to Zimmer) LaSalle, Fermi-2, Grand Gulf, and, with a slight modification, Clinton.

DESIGNATED ORIGINAL

Notified By

K. J. [Signature]

With a letter (L. Holtzscher, Illinois Power Company, to Howard J. Faulkner, NRC) dated May 17, 1982, LRG-II submitted a position paper on channel box deflection that incorporated several of the same features as the Zimmer proposal, viz:

- a) Records will be kept of channel locations and exposure for each operation cycle.
- b) Channels shall not reside in the outer row of the core for more than two operating cycles (because flux gradients are largest near the core periphery and, therefore, differential irradiation-induced growth and bowing will be greatest at those locations.)
- c) At the beginning of each fuel cycle, the combined outer row residence time for any two channels in any control rod cell shall not exceed four peripheral cycles.

In addition, LRG-II stated that channels that reside in the periphery (outer row) for more than one cycle shall be situated each successive peripheral cycle in a location which rotates the channel so that a different side faces the core edge. We believe that this should help to reduce uni-directional irradiation-induced growth, and should thus lessen channel bowing, and that the other measures outlined above would also help to reduce the magnitude of channel deflection.

Like the Zimmer proposal, the LRG-II position statement contains a description of a control rod drive friction test that would be performed for those core cells exceeding the above general guidelines or containing channels with exposures greater than 30,000 Mwd/t (associated fuel bundle exposures). In the LRG-II position paper, the control rod drive settling friction test is described in considerable detail. For instance, it is stated that after reload and again before reaching 40% thermal power, a friction test shall be performed (for those cells exceeding the above general guidelines), in which each control rod will be allowed to settle a total of two notches, one notch at a time, from the fully inserted position. Total control rod drive friction would be acceptable if the rod settles, under its own weight, to the next notch within approximately ten seconds.

The settling friction test described by the LRG-II is said to provide an equivalent level of test to that described in NEDE-21354. To be precise, the LRG-II test is equivalent to a so-called "screening-type" test (described in NEDE-21354) to identify any control rod drive where the force required to insert is greater than approximately 250 lbs. (equal to the settling pressure times the piston area). But whereas in NEDE-21354, it is indicated that rods failing the screening test would be given another settling friction test to obtain an exact friction-versus-position profile, the latter type of test is not mentioned by LRG-II. The LRG-II position is that failure of the proposed settling time test would "prompt an investigation," which, if necessary, would lead to corrective action.

While we believe that a commitment to perform an exact settling friction profile test (or actual dimensional measurement) is preferable (because it would provide an estimate of the margin and physical state of the system in an unambiguous way), the LRG-II and General Electric Company (in NEDE-21354) have stated that the control rod drives will tolerate a relatively large increase in driveline friction (~350 lbs.) while still remaining within technical specification limits. The screening-type test proposed by LRG-II would, thus, provide assurance of the scram function. Therefore, we accept the LRG-II position that the proposed actions will preclude excessive channel bowing in the LRG-II plants (i.e., River Bend and Perry). We are continuing our review of this phenomenon (and the GE report), however, and should our review indicate that a modification to the proposed steps is necessary, the licensees will be so notified.