50-335-OLA
A-3
1/24/89

Ex. 3

SYSTEM ENERGY RESOURCES, INC.

JOHN G. CESARE, JR.
Director
Nuclear Licensing

November 21, 1988

DOCKETED USNRC

'89 MAR 22 P6:58

OFFICE OF SECRETARY
DOCKETING & SERVICE
BRANCH

U. S. Nuclear Regulatory Commission
Mail Station P1-137
Washington, D. C. 20555

Attention: Document Control Desk

Gentlemen:

SUBJECT: Grand Gulf Nuclear Station
Unit 1
Docket No. 50-416
License No. NPF-29
Request for Additional Information
Criticality Analysis for Cycle 4
AECM-88/0233

By letters dated October 27, 1988 and November 15, 1988 (AECM-88/0206 and 0228 respectively), System Energy Resources, Inc. (SERI) requested the NRC to review the criticality analysis for Cycle 4 fuel to be stored in the Grand Gulf Nuclear Station, Unit 1 spent fuel pool storage racks prior to loading in the reactor.

Based on its review, the NRC Staff requested additional information (MAEC-88/0336, dated November 8, 1988) regarding the Boraflex material contained in the racks and the associated Boraflex monitoring program. SERI's response to the NRC request for additional information is attached.

If you have additional questions please advise.

Yours truly,

M. L. Crawford
for J. G. Cesare

JGC:swb
Attachment

cc: (See next page)

8903270291 890124
PDR ADOCK 05000335
G PDR

P O BOX 23070 | JACKSON, MISSISSIPPI 39225-3070 | (601) 984-9210
A Middle South Utilities Company

J22AECM88111801 - 1

cc: Mr. W. T. Cottle (w/a)
Mr. T. H. Cloninger (w/a)
Mr. R. B. McGehee (w/a)
Mr. N. S. Reynolds (w/a)
Mr. H. L. Thomas (w/o)
Mr. H. O. Christensen (w/a)

Mr. Malcolm L. Ernst (w/a)
Acting Regional Administrator
U. S. Nuclear Regulatory Commission
Region II
101 Marietta St., N. W., Suite 2900
Atlanta, Georgia 30323

Mr. L. L. Kintner, Project Manager (w/a)
Office of Nuclear Reactor Regulation
U. S. Nuclear Regulatory Commission
Mail Stop 14B20
Washington, D.C. 20555

Response to NRC Question Regarding

GGNS Boraflex Gap Surveillance Program

Introduction

As described in NRC Information Notice No. 87-43, Commonwealth Edison Company (CECO) has observed gaps in the neutron-absorbing material used in the Quad Cities high-density spent fuel storage racks. These racks were manufactured by the Joseph Oat Corporation (OAT). The neutron-absorbing material is a boron carbide dispersion in an elastomeric silicone matrix which is manufactured by Bisco Products, Inc. (BISCO) under the trade name Boraflex.

On May 5, 1987, CECO presented to the NRC under Dockets No. 50-254 and 50-265 the results of measurements and criticality analysis relating to the observed presence of gaps in Boraflex panels used in the Quad Cities spent fuel pool racks. Additionally, EPRI has evaluated BISCO and Utility data relating to the degradation of Boraflex as reported in the November 1988 presentation of the draft report RP-2813-4 to EPRI Boraflex working group member utilities.

Gap Formation

As described in these reports, the formation of gaps is postulated to be caused by radiation induced shrinkage in the Boraflex panels due to crosslinking in the Boraflex polymer. When this shrinkage occurs in the presence of some structural element(s) which restrict the shrinkage, local stress accumulates until the panel tears. The elements of this scenario are present in the high density spent fuel racks manufactured by OAT such as those installed at Quad Cities and GGNS.

Gap Measurements

In response to NRC Information Notice 87-43, tests for the presence of gaps in the GGNS spent fuel racks were conducted during August, 1988.

The test apparatus consisted of a Californium-252 neutron source and 4 sets of Boron tri-Flouride thermal neutron detectors enclosed in a specially designed logging tool. The detectors are shielded from the fast neutrons produced by the Ca-252 source but detect any thermal neutrons which will be reflected from adjacent storage rack cells if gaps in the Boraflex are present. A set of detectors is mounted on each wall of the logging tool in order to test four Boraflex panels at once. This design minimizes uncertainties with respect to the elevation of gaps. This device is lowered into the storage rack cell to be tested and slowly moved up the channel at approximately 1 foot/minute. This process allows detection of gaps greater than 1/2 inch.

The results of this test were provided to SERI in October, 1988. The tests were performed on 101 storage rack cells (total of 404 Boraflex panels). These cell locations have typical radiation histories for the GGNS spent fuel storage racks. Of these, 48 had not previously been used to store irradiated fuel. No gaps were found in the unirradiated cells. In the irradiated cells 87 gaps were observed in 85 panels with 127 panels showing no evidence of gaps. The average gap size was approximately 0.8 inch, with a maximum gap size of 1.4 inch.

Gap Impact Assessment

3-D KENO models were developed to assess the impact of the observed gaps on the spent fuel rack criticality analysis. These models included gaps in the mid-plane of all Boraflex panels equal to the maximum observed gap size plus the associated measurement uncertainty. An infinite number of cells, in this configuration, was assumed to be present in the radial direction. This is a very conservative treatment since the GGNS and Quad Cities measurements indicate that the gaps are essentially randomly distributed except for a slight bias towards the mid-plane. No storage cells in the GGNS racks were observed to have 4 gaps in the same plane.

Results of analyses using the 3-D KENO models demonstrated that if the presence of the maximum observed gap size had been explicitly accounted for in the Cycle 4 spent fuel criticality analyses [SERI letters to NRC serial AECM-88/0206 and AECM-88/0228], the reported reactivity would not have increased. An analysis of a 3 inch gap in the mid-plane of all Boraflex panels demonstrated significant margin to the 0.95 k-effective acceptance criteria. Additionally, if a more realistic treatment of the distribution of gap sizes and locations had been included, gaps substantially larger than those observed would not result in an increase in the reported rack reactivity. Since the formation and growth of gaps is slow, no immediate concern for the integrity of the GGNS racks exists.

However, the potential for continued growth and gap formation exists. In order to assess the long term impact of the degradation of the Boraflex panels upon spent fuel rack criticality, a detailed evaluation of the available industry data is currently in progress. The objective of this evaluation is to establish a maximum credible gap size and distribution for the GGNS racks. In conjunction with this assessment, a more detailed criticality analysis is underway in order to determine the long term impact of the formation of gaps on the criticality of the spent fuel racks at GGNS. These analyses are currently scheduled for completion on or about February 15, 1988.

Surface Degradation

In July of 1986, Wisconsin Electric Company, the licensee of Point Beach 1 and 2 reported significant degradation in test coupons of Boraflex material. As reported in NRC Information Notice 87-43, subsequent examination of full length panels disclosed 1-2 percent of the surface showed a gray discoloration at the edges. No evidence of this degradation has been observed in the GGNS test coupons.

Monitoring Program

Since little industry data is available concerning the formation of gaps in the Boraflex for OAT racks, SERI intends to continue monitoring the GGNS spent fuel racks until gap sizes and the distribution of gaps are no longer significantly changing. The monitoring will use methods equivalent to those previously described. Due to the observed slow formation and growth of these gaps, one set of measurements each cycle is considered adequate.

Approximately 50 storage rack cells are planned for monitoring each cycle. The cells will be loaded with discharged fuel during each refueling outage. After significant additional irradiation, the fuel in the specified cells will be moved and additional measurements will be performed. This process will maximize the formation of gaps. This process will provide an early indication of any significant changes in the behavior of the Boraflex and a confirmation of any assumptions used in the criticality analyses.

The Boraflex coupon surveillance program described in the original licensing basis for the racks (SERI letter to NRC serial AECM-85/0143) will continue and provide a basis to monitor for the possible surface degradation of the panels.

Summary

While the presence of small gaps in the GGNS spent fuel rack Boraflex has been detected, they have no impact upon the criticality safety analysis currently under review by the NRC Staff. Since larger gaps have been observed at other sites, a detailed assessment of the long term impact is on schedule for completion in February, 1989. In order to assure that the basis for this assessment remains valid, periodic measurements of the specified storage rack cells will be performed until gap sizes and the gap locations are no longer significantly changing.