GPU NUCLEAR

GPU Nuclear, Inc.
U.S. Route #9 South
Post Office Box 388
Forked River, NJ 08731-0388
Tel 609-971-4000

October 15, 1996
6730-96-2300

U.S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, D.C. 20555

Dear Sir:

Subject: Oyster Creek Nuclear Generating Station
Docket No. 50-219
Response to Generic Letter 96-04

Generic Letter 96-04 informed all licensees of the issues concerning the use of Boraflex in spent fuel storage racks. Since the Oyster Creek racks contain Boraflex, GPU Nuclear is responding to the NRC's request for additional information. For your review, we are providing an attachment which addresses your specific questions on the performance of Boraflex in our spent fuel storage pool.

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If you have any questions, please contact Terry Sensue, Regulatory Affairs Engineer, at telephone number 609 971-4680.

Very truly yours,

Michael B Roche

Michael B. Roche
Vice President & Director
Oyster Creek

MBR/DGJ

Attachments

cc: Administrator, Region I
NRC Project Manager
NRC Resident Inspector

Sworn and Subscribed to before me this 15th. day of October, 1996.

Geraldine E Levin

A Notary Public of NJ

GERALDINE E. LEVIN
NOTARY PUBLIC OF NEW JERSEY
My Commission Expires 6-9-2000

ATTACHMENT

OYSTER CREEK
RESPONSE TO NRC GENERIC LETTER 96-04 ON BORAFLEX PERFORMANCE IN THE SPENT FUEL POOL

NRC Request No. 1

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 methods 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.

GPUN Response No.1

A Boraflex coupon surveillance test has been in effect since 1986 when the new high density poison racks were installed by the Joseph Oat Corporation. The surveillance coupons are approximately 2"x 4"x0.045" Boraflex sheets encased in stainless steel and placed on a sample holder. There are two sample holders containing coupons for long term and accelerated exposure testing. The accelerated coupons are positioned to receive exposure at a faster rate than the spent fuel racks and are tested biennially to serve as an early indication of boraflex degradation. The last surveillance test was performed on both accelerated and long term coupons in April, 1995. The surveillance included dimensional and hardness checks, neutron attenuation test, areal density measurements, and dynamic shear modulus testing. Based on the test report[1] issued on July 14, 1995, the accelerated coupons are at an integrated dose rate of 1.3×10^9 rads and show changes consistent with boraflex exposed to that level of gamma radiation. The test results do not indicate any significant loss in B_4C or in the polymer matrix.

Due to the Oyster Creek rack design, the Boraflex panels are not directly exposed to fuel pool water perturbations and therefore are resistant to loss of silica due to long term exposure to fuel pool water flow. Although small holes exist on each panel for the purposes of gas release, it does not provide sufficient communication with the fuel pool water to cause degradation due to water impingement. Therefore, the coupon surveillance should be indicative of the Boraflex performance in the fuel racks.

A criticality analysis was performed on the spent fuel racks for fuel enriched to 4.0 w/o U_{235} having a minimum gadolina loading of 7 rods containing 3.0% GD_2O_3 at peak reactivity and with the effect of gaps in the Boraflex panels. The calculated k_{eff} is 0.945 indicating a margin of 0.005 to the acceptance criterion of k_{eff} no greater than 0.95. The criticality analysis[2] was reviewed by the NRC as part of an Oyster Creek technical specification change request to increase the capacity of the spent fuel racks from 2600 fuel bundles to 2645 fuel bundles. The criticality analysis uses the CASMO-3 integral transport code and the KENO-Va Monte Carlo code which have been extensively benchmarked for this type of analysis. The analysis

used a very conservative assumption that the gaps were 3.9 inches, occurring in all of the Boraflex panels in the same axial plane to maximize neutron coupling.

EPRI has sponsored the development of the computer program RACKLIFE[3] to track the performance of individual panels in the racks as a function of service. RACKLIFE will be used by GPUN to determine the performance of the Boraflex panels in the Oyster Creek spent fuel pool. Oyster Creek is a member of EPRI's Enhanced Boraflex R&D program and has participated in their RACKLIFE training workshops. A RACKLIFE input database is being prepared for the Oyster Creek spent fuel pool to provide the quantity of boraflex (and boron-10) lost as a function of service history. The RACKLIFE program will be used to determine when future actions are necessary.

As an interim measure, a calculation was performed to estimate the impact of silica loss on the criticality analysis to insure no immediate action was necessary to prevent exceeding the k_{eff} design criterion. The analysis used the rate of silica buildup in the fuel pool to estimate past and future silica loss. The calculation indicates that the 0.95 criterion will be exceeded by the year 2001 prior to the end of plant life. This is due to the small margin between the conservatively calculated k_{eff} and the design criterion for the criticality analysis rather than from any accelerated loss of B_4C. It has been shown[4] that using distributed gaps in the criticality analysis instead of the very conservative assumption that all gaps occur in the same axial plane, an additional 0.02 Δk in margin is possible. An additional 0.01 Δk would result in extending the criticality margin well beyond the end the Oyster Creek's licensed end of life.

Should surveillance results or other symptoms indicate unacceptable Boraflex performance, a quantitative In-Situ testing of Boraflex in the racks can be conducted using the EPRI developed BADGER - Boron Areal Density Gage for Evaluating Racks, which provides panel average and local boron-10 areal density measurements.

NRC Request No.2

Describe any proposed actions to monitor or confirm that this 5 percent subcriticality margin can be maintained for the lifetime of storage racks, and describe what corrective actions could be taken in the event it cannot be maintained.

GPUN Response No. 2

Oyster Creek is considering a number of options to insure that the 5 percent criticality margin can be maintained for its lifetime. The first is a re-evaluation of the criticality analysis to determine the additional margin that is available. As stated above, up to an additional 0.02 delta k is possible. The second is an offload management program to distribute the freshly discharged fuel to racks having lower exposure. The RACKLIFE model can be utilized to identify racks that have the highest exposure and should not have freshly discharged fuel loaded into those racks. Finally, GPUN is considering the use of additives in the spent fuel pool which could inhibit silica loss and prolong the life of the racks.

Should rack locations experience Boraflex degradation such that the spent fuel pool k_{eff} could exceed the design criterion of k_{eff} less than 0.95, RACKSAVER[5] or similar neutron absorber device will be inserted into those areas experiencing the unacceptable degradation.

NRC Request No. 3

Describe the results from any previous post operational blackness tests and state whether blackness testing or other in-situ tests or measurements will be periodically performed.

GPUN Response No. 3

Blackness testing was performed on the Oyster Creek spent fuel racks in 1993. A total of 240 panels were tested resulting in 93 panels with detectable gaps and only 6 with multiple gaps in the same panel. The largest gap was 1.8 inches and the largest total gap size found in one panel was 2.42 inches (two gaps of 1.07 and 1.35 inches). The gap formation for the exposure level of the measured Boraflex panels is consistent with industry data reported by EPRI[4] for racks designs similar to Oyster Creek's design. Although gap size will continue to increase with gamma exposures until the saturation dose of 2×10^{10} rads is reached, gap formation is expected to remain consistent with industry data and be bounded by the upper limit of 2.8 %. Additional shrinkage will occur at the top and bottom ends of the Boraflex panels for a total of 4.0% shrinkage.

The 2.8% shrinkage forms a maximum panel gap of 3.9 inches which was used in the Oyster Creek criticality analysis. There are no plans to do additional blackness testing unless the coupon surveillance indicates shrinkage beyond what has been projected and used in the criticality analysis.

NRC Request No. 4

Chronological trends of pool reactive silica levels along with timing of significant events such as refueling, pool silica cleanup etc. should be provided. Implications of how these levels relate to Boraflex performance should be described.

GPUN Response No. 4

Silica concentration measurements are made on a routine basis as part of normal fuel pool chemistry monitoring (see attached Oyster Creek Reactive Silica Graph). The procedural requirement for silica is that the levels must be brought down to less than 500 ppb (EPRI Guidelines) prior to the start of a refueling outage when the pool water commingles with the reactor water.

As stated in response to NRC Request No. 1, a calculation based on Silica buildup indicates that Silica loss will result in exceeding the design criterion for a subcritical margin of 5 percent. The implications are clear that boraflex performance must be closely monitored and the actions described in GPUN Response No. 2 must be completed as necessary.

References:

{1} GPUN Chemistry/Materials Report No. 5383-95-1115 Rev. 0, "Inspection and Testing of Boraflex Surveillance Coupons Oyster Creek Nuclear Station," July 14, 1995.

{2} Letter to J.J. Barton (GPUN) from A. W. Dromerick (NRC), "Issuance of Amendment (TAC No. M90999)," dated April 10, 1995.

{3} RACKLIFE User's Manual, NET-092-04, Northeast Technology Corp. Kingston, NY; March 1996

{4} Boraflex Test Results and Evaluation, TR-101986. Electric Power Research Institute: Palo Alto, CA; February 1993

{5} Lambert, R.P. O'Leary and P. Roberts, RackSaver Neutron-Absorbing Device Development and Training, Trans. Amer. Nucl. Soc., June 1996.

Oyster Creek Reactive Silica