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June 15, 1990

Dr. Thomas E. Murley, Director
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

ATTN: Document Control Desk

Subject: Quad Cities Station Unit 1
Neutron Radioassay Measurement Quad Cities Unit 1
Spent Fuel Storage Pool
NRC Docket No. 50-254

Reference: (a) M.S. Turbak to A. Bert Davis letter dated July 22, 1987
(b) I.M. Johnson to T.E. Murley letter dated February 22, 1989

Dr. Murley:

In July, 1986 Quad Cities Nuclear Power Station was notified that Point Beach Nuclear Power Station identified degradation of the Boraflex material (neutron absorber) contained in the high density spent fuel storage racks during surveillance testing. As a result, Quad Cities Station examined the condition of the High Density Spent Fuel Storage Racks in the Unit 1 Fuel Pool. The testing identified that anomalies had formed in the fuel storage racks.

Reference (a) transmitted an assessment of the Boraflex material anomaly at Quad Cities. Reference (b) transmitted "Quad Cities Neutron Radioassay Measurement Guidelines" for information and described the surveillance of the Unit 1 storage racks. The attached summary provides the results of the neutron radioassay measurement program conducted during the Fall, 1989 Refueling outage for the Unit 1 High Density Spent Fuel Storage Racks. The Final Report of the Special Neutron Attenuation Test for High Density Spent Fuel Racks is also enclosed.

If you have any questions, please do not hesitate to contact this office.

Very truly yours,

Rita Stols

Rita Stols
Nuclear Licensing Administrator

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cc: A. Bert Davis, Regional Administrator
L. N. Olshan, Project Manager
Senior Resident Inspector, Quad Cities

Attachment

Summary of Results

Background

In July, 1986 Quad Cities Nuclear Power Station was notified that Point Beach Nuclear Power Station identified degradation of the Boraflex material (neutron absorber) contained in the High Density Spent Fuel Storage Racks. This degradation was discovered during surveillance testing on the High Density Fuel Racks and was observed in locations that had reached high exposure levels (approximately 1×10^{10} rads). The high exposure levels were attributed to placing the freshly unloaded fuel in the same location each outage.

Because of similar operating practice, the Quad Cities staff was concerned that their Boraflex material might also be affected. This concern prompted Quad Cities to examine the condition of the High Density Spent Fuel Storage Racks in the Unit 1 Fuel Pool. The reload racks are used to accommodate the freshly unloaded fuel during each refueling outage, in contrast to the discharge racks which are used for long term storage for depleted fuel assemblies. The reload racks will therefore, be subject to higher exposures and undergo more thermal cycles than the discharge racks. The testing showed that gaps had formed in the High Density Spent Fuel Storage Racks and, as expected, the reload racks contained the most and largest gaps. Future testing was planned to continue on the Unit 1 fuel racks because they have reached higher exposure than the Unit 2 racks.

The data obtained during the 1986 testing campaign was used with theoretical behavior data to formulate a conservative Gap Growth Model. This model, along with conservative assumptions, was used in a criticality analysis of the fuel pool. The results of the analysis showed that the criticality of the spent fuel pool would not reach or exceed the Technical Specification Limit of $K_{eff} = 0.95$ provided that the Gap Growth Model is bounding and each fuel bundle is limited to a maximum $K_{infinity}$ of less than 1.26. This criticality analysis concluded that a random gap distribution of various sizes up to and including (10) inches in the Boraflex material would still meet Technical Specification requirements.

Results of Testing Conducted During Fall, 1989 Unit 1 Refueling Outage

Of the thirty one (31) gaps detected by the special test method in 1986, eight (8) gaps showed growth during the 1989 in-situ test. The growth was in the range of 1/2 to 1 inch. The largest gap detected in 1986 (between 3 and 4 inches) showed no change in size during the 1989 examination.

During the 1989 testing, twenty (20) additional cells, containing eighty (80) total Boraflex panels, were examined with the special test method. A total of twenty-two (22) Boraflex panels displayed anomalies. In one of these panels, two (2) gaps were detected (a gap size of 1 to 2 inch in the lower region and, in the upper region, a gap size of 1/2 to 1 inch). The distribution of the twenty three (23) gaps was as follows:

2 gaps in the 1/2 to 1 inch range
6 gaps in the 1/to 2 inch range
14 gaps in the 2 to 3 inch range
1 gap in the 3 to 4 inch range

Results of Testing Conducted During Fall, 1989 Unit Refueling Outage (cont'd)

A mapping of all 1989 results confirms a random nature for the distribution of gap sizes. Overall, the 1989 results show little or no growth for the gaps initially measured in 1986 by the special test method. The twenty (20) new cells tested during the 1989 testing campaign displayed a gap size distribution in the same range as the cells tested in 1986, with a nominal gap size comparable, but slightly higher, than those other cells tested during 1986 and 1989.

Conclusion

The growth of gaps since 1986 has been relatively slight and is well within the bounds predicted by the Northeast Technology Corp. (NETCO) Gap Growth Model.

Additional in-situ Boraflex testing prior to the next Quad Cities Unit 1 refueling outage (Fall 1990) will not be conducted based upon:

1) a comparison of 1986 and 1989 in-situ rack testing results demonstrates little or no Boraflex gap growth, and,

2) the results of the criticality assessment (provided in reference (a)), which qualified the Quad Cities spent fuel storage racks to meet the NRC acceptance criteria (an effective neutron multiplication factor of less than 0.95), remain valid based on the test results which demonstrated that the randomly distributed gaps of various sizes remain within the upper boundary of the NETCO gap growth model.

Further Actions

1) Testing will be conducted prior to the Spring, 1992 Unit 1 Refueling Outage. This schedule would provide information after two exposures with freshly unloaded fuel.

2) Approximately five (5) Quad Cities Unit 2 rack cells will be examined utilizing the special test method to benchmark initial gap growth. This testing will be completed by March 31, 1992. The cumulative radiation exposure for the Unit 2 storage cells will be less than the level of exposure of the Unit 1 cells in November, 1986; therefore, Commonwealth Edison considers this schedule for Unit 2 is appropriate.