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REID,R.W. OPERATING REACTORS BRANCH 4

SUBJECT: FORWARDS RESULTS OF FUEL SURVEILLANCE PROGRAM PER TECH SPEC 4.13.3.RESULTS INDICATE THAT BABCOCK & WILCOX FUEL ASSEMBLY IS PERFORMING AS EXPECTED & DIMENSIONAL CHANGES ARE CONSISTENT W/PREDICTED VALUES.

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March 2, 1979

WILLIAM O. PARKER, JR.
VICE PRESIDENT
STEAM PRODUCTION

TELEPHONE: AREA 704
373-4083

Mr. Harold R. Denton, Director
Office of Nuclear Reactor Regulation
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Attention: Mr. R. W. Reid, Chief
Operating Reactors Branch #4

Re: Oconee Nuclear Station, Unit 1
Docket No. 50-269

Dear Sir:

Pursuant to Oconee Nuclear Station Technical Specification 4.13.3, please find attached the results of the fuel surveillance program conducted in accordance with Specifications 4.13.1 and 4.13.2.

These results indicate along with other data obtained that the Babcock & Wilcox 15X15 fuel assembly in use at Oconee is performing as expected and dimensional changes are consistent with predicted values.

Very truly yours,

William O. Parker, Jr.

RLG:scs
Attachment

A001 s/11

Oconee Nuclear Station, Unit 1
Results of Fuel Surveillance Program
of Technical Specification 4.13

VISUAL INSPECTION

A total of four assemblies were examined after each Unit 1 cycle, designated by the following identification numbers: 1C30, 1C63, 1C66 and 1C73. Average assembly burnup ranged from 6500 to 10,000 MWd/mtU at end-of-cycle 1 (EOC-1); 16,000 to 18,500 at EOC-2; and 24,000 to 26,000 at EOC-3.

The visual inspection was conducted with underwater television and optical periscope viewing devices. Two hundred twenty-four peripheral fuel rods were inspected over their entire visible length. No evidence of defects (e.g. holes, cracks, unusual crud patterns) was seen on any of the fuel rods.

Crud patterns were fairly typical of PWR fuel, showing axial variations in shading and evidence of disturbed coolant flow above the spacer grids. Minor changes in pattern were noted from cycle to cycle, but there was no indication of loss of integrity in any of the 224 rods.

DIMENSIONAL EXAMINATION

Rod length measurements were made on selected peripheral rods whose end caps were visible through specially-fabricated cutouts in the upper and lower end skirts. As-built length was measured with a steel tape extending along the rod. Irradiated length was determined using a calibrated and tensioned steel tape extending from the top to the bottom of the fuel assembly at the center of each assembly face. A photograph was taken through an optical periscope of each rod end with the tape in the field of view, and the location determined from the photograph. Rod length was then obtained from the differences in the readings. Corrections were made for tape and rod thermal expansion and tape elongation due to tension. Rod growth for each cycle was then obtained by subtracting the as-built measurement for each rod, and expressed as a percentage of the as-built length. Measurement error varied with the quality of the photographs; the maximum individual rod growth error is estimated at $\pm$ 0.08% $\Delta L/L$. Individual rod growth data is shown in Figure 1 as a function of calculated rod average burnup.

As-built cladding outside diameter measurements were taken with a micrometer at the top, center and bottom of each rod. Diameter measurements after irradiation were taken using two methods. The Oconee site measurements used a line-scan profilometry device which measured the diameter of peripheral rods in a direction parallel to the assembly face with sapphire finger diameter calipers. A continuous trace was obtained for each rod, extending over the full length except for those portions shielded by the spacer grids and the upper and lower ends which were inaccessible due to limitations on test head travel. The spacing between the diameter calipers was read using a linear variable differential transformer and calibrated periodically with a stepped, hardened steel rod of known diameter. Accuracy of the measurement is estimated at 0.0002 inches.

Because the site diameter measurement device was not operable following EOC-1, first-cycle diameter data is presented from an Oconee Unit 1 assembly which was destructively examined following the first cycle. The diameter of several extracted rods was measured using a step scan device similar in design and accuracy to the on-site equipment. The scanning method differed, however, in that each rod was rotated in the test head at selected intervals of approximately 0.25 inch to obtain maximum and minimum diameter at evenly-spaced axial intervals in addition to a straight line-scan trace in one vertical plane.

Because of the spiral nature of the rod ovality, the site line-scan traces cannot be used to obtain an exact value for the mean diameter at a given horizontal plane. However, by digitizing the traces and using a data-averaging technique on orthogonal line-scans on corner rods, a good approximation of average mean diameter over a single span length between two adjacent spacer grids can be obtained. Where available, the as-built rod diameter data was used to calculate the change in mean diameter; otherwise the nominal value was used.

Profilometry scans were made on seven rods extracted from assembly 1A16, which had been irradiated in cycle 1 of Oconee Unit 1. Average burnup for the rods ranged from 10,600 to 11,000 MWd/mtU. For each rod, the mean diameter was calculated at one-inch intervals along its length, and the decrease in diameter (creepdown) calculated from beginning-of-life values. For each rod, an average creepdown value was obtained using all the interval values. The results for the seven rods ranged from 1.5 to 2.2 mils, with an overall average of 1.9 mils. The maximum creepdown for each rod averaged 2.7 mils, with a range of 2.2 to 3.0 mils.

Similar values were obtained on 2- and 3-cycle assemblies using the on-site line-scan equipment. Again, the diameter at one-inch intervals was used as the basic parameter in calculating creepdown. For each rod, an average diameter over each of the seven grid-span lengths was obtained. The maximum and average creepdown were then obtained from these data. A total of 14 corner rods from assemblies 1B08, 1B29, 1C44, and 1C56 were measured after two cycles in Oconee Unit 1. The average creepdown varied from 2.1 to 3.8 mils, with an average of 2.7 mils. The maximum ranged from 2.6 to 4.5 mils, with an average of 3.3 mils. The burnup on these rods ranged from 15,100 to 21,200 MWd/mtU. No strong correlation was seen between burnup and creepdown for this group.

A total of eight corner rods from assemblies 1C63 and 1C66 were similarly measured at the end of cycle 3. These rods had burnups ranging from 21,600 to 27,000 MWd/mtU. Rod average creepdown varied from 3.4 to 4.6 mils, with an overall average of 4.0 mils. Peak creepdown for each rod ranged between 3.8 and 5.0 mils, with an average of 4.4 mils. Table 1 summarizes the 3-cycle creepdown data.

TABLE 1

3-Cycle Creepdown Data

Irradiation Cycles	No. of Rods	Burnup Range, MWd/mtU	Overall average Creepdown, mils
1	7	10,600-11,000	1.9
2	14	15,100-21,200	2.7
3	8	21,600-27,000	4.0

FIGURE 1 - INDIVIDUAL ROD GROWTH DATA THROUGH 3 CYCLES