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POWER BUILDING
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WILLIAM O. PARKER, JR.
VICE-PRESIDENT
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TELEPHONE: AREA 704
373-4083

March 16, 1976



Mr. Benard C. Rusche
Director of Nuclear Reactor Regulation
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Re: Oconee Unit 1
Docket No. 50-269

Dear Mr. Rusche:

Duke Power Company has recently been appraised of damage to the reactor vessel surveillance holder tubes which has occurred in another Babcock and Wilcox reactor. An inspection of the Oconee 1 surveillance specimen tube holders has been performed during the present refueling outage. Based upon the results of this inspection, the following actions will be taken during Oconee 1, Cycle 3 operation:

1. The reactor vessel surveillance capsules and push rods will be removed.

2. The reactor vessel surveillance holder tubes will be secured from motion by a spring-loaded retaining device which will be loaded into the upper end of each holder tube.

The attached report describes the inspection of the Oconee 1 surveillance holder tubes and provides the justification for operation of Oconee 1, Cycle 3 with the surveillance specimens removed.

Pursuant to 10 CFR 50, §50.12, an exemption from the requirements of 10 CFR 50, Appendix H, Section II.c.2 is requested to permit the operation of Oconee 1, Cycle 3 with the reactor vessel surveillance specimens removed from the reactor vessel. It is also requested, pursuant to 10 CFR 50, §50.90, that the Oconee Nuclear Station Technical Specifications be revised to indicate that the specimens will be removed from the reactor vessel for Cycle 3 operation and that the surveillance withdrawal schedule will be revised prior to Cycle 4 operation. The attached proposed Technical Specification replacement page shows this change. It is considered that the operation, for one cycle, with the reactor vessel surveillance specimens removed will not be inimical to the health and safety of the public.

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Oconee 1 is scheduled to resume operation on March 26, 1976 following completion of the refueling outage. Your prompt attention to this request for exemption is therefore requested. Oconee 2 and 3 reactor vessel surveillance holder tubes will be addressed in separate correspondence in the near future.

Very truly yours,

William O. Parker, Jr.

MST:mmb

Attachment

WILLIAM O. PARKER, JR., being duly sworn, states that he is Vice President of Duke Power Company; that he is authorized on the part of said Company to sign and file with the Nuclear Regulatory Commission this request for amendment of the Oconee Nuclear Station Technical Specifications, Appendix A to Facility Operating Licenses DPR-38, DPR-47 and DPR-55; and that all statements and matters set forth therein are true and correct to the best of his knowledge.

William O. Parker, Jr.

William O. Parker, Jr., Vice President

ATTEST

John C. Goodman, Jr.

John C. Goodman, Jr.
Assistant Secretary

Subscribed and sworn to before me this 16th day of March 1976.

Notary Public

My Commission Expires:

# OCONEE 1 REACTOR VESSEL SURVEILLANCE HOLDER TUBE

## INTRODUCTION

Duke Power Company has been appraised by the Babcock and Wilcox (B&W) Company that damage to the reactor vessel surveillance holder tubes in another B&W reactor had been observed. The three Oconee 1 surveillance specimen holder tubes were inspected during the current refueling outage. Based on the results of these inspections, Oconee 1 will by operated during Cycle 3 with the surveillance specimen capsules and push rod assemblies removed. This report demonstrates the acceptability of these actions.

## SURVEILLANCE CAPSULE HOLDER ARRANGEMENT

The design of the surveillance capsule holder tube is described in B&W Topical Report BAW-10006A.[1] The surveillance capsules are attached to and secured within the holder tube by a spring-loaded push rod assembly as shown in Figure 2-8 of Reference 2. The plenum flange compresses the push rod assembly spring as the plenum is lowered into the core support shield. The spring-loaded push rod assembly has four spacers mounted along its axial length to provide lateral positioning of the push rod. The top two of these spacers, which are of single piece construction and cloverleaf shape, are located in that portion of the axial length of the holder tube which is within the shroud tube. The third spacer is axially located in a portion of the holder tube with a thicker wall and within a journal bearing mounted to the core support shield. The fourth spacer is approximately in the center of the ogee bend in the holder tube. A female fitting on the lower end of the push rod mates with the top end fitting of the upper surveillance capsule as shown in Figure 2-11 of Reference 2. The bottom end fitting of the lower surveillance capsule mates with a special fitting in the base of the holder tube which restrains the capsules from rotation. In one of the three holder tubes, thermal aging capsules are also located at the first spacer axial location.

## SURVEILLANCE TUBE INSPECTION

All three surveillance specimen holder tubes were inspected by remote video techniques for evidence of wear on the internal surface. Evidence of wear was noted at each of the push rod spacer locations (with the exception of the first spacer location in the tube containing the thermal aging specimens), at the location of the holddown spring, at the surveillance capsule rings, and at a location between the third and fourth spacers. This latter wear was attributed to contact and relative motion between the push rod and holder tube. The other wear sites are attributed to contact and relative motion between the holddown spring, spacer or surveillance capsule and the holder tube at their respective locations.

Although there are indications of significant wear, all three tubes are intact and retain their structural integrity. The wear does, however, penetrate through the holder tube wall at the second, third and fourth

spacer locations on all three tubes. This penetration has been observed to be limited to the azmuthal orientations of two of the four lobes of the cloverleaf spacer. The damaged area at the fourth spacer location, in the worst case, is only about twenty to thirty percent of the tube circumference, and there is an undamaged ligament in the circumference between the damage sites.

## CORRECTIVE ACTION

Evaluation based on the inspection results conclude that the Oconee 1 holder tubes retain sufficient integrity to remain in the reactor vessel. It has been concluded that the most likely cause of the observed tube wear is flow-induced relative motion between the surveillance capsule train and the holder tube. To minimize the possibility of unacceptable wear occurring during Cycle 3, the following steps are to be taken:

1. The surveillance capsules and push rod assemblies are to be removed during Cycle 3 operation, and

2. The holder tubes will be secured from motion by a spring-loaded retaining device, similar to the existing holddown device, which will be loaded into the upper end of each holder tube.

This action will allow time for the engineering of holder tube and push rod assembly design modifications and material procurement prior to the resumption of the surveillance capsule irradiation program in Cycle 4. Removal of the specimens from the reactor vessel for one cycle will not adversely affect the results of future testing of these specimens or the overall results of the surveillance program.

## SAFETY EVALUATION

### Reactor Vessel

The proposed technical specification revisions requested by our letter of October 1, 1975 provide the operating pressure and temperature limitations, in accordance with Appendix G to 10 CFR 50, applicable up to the end of five EFPY of operation. These limitations are based on the results of analyses presented in BAW-1421.[3] An additional capsule has been removed at the end of Cycle 2, and those specimens will be tested during Cycle 3. The results will be considered for further modification of the operating pressure and temperature limitations of Oconee Unit 1. These modifications will provide additional assurance of adequate fracture toughness properties for the period until the next surveillance capsule withdrawal and testing. The neutron fluence at the center of the surveillance specimens is reported in Reference 1 to be approximately 1.7 times the maximum fluence at the reactor vessel wall. As reported in Reference 2, a more recent calculation of the flux values using improved methods has been performed for the Oconee class reactors. These later results indicate that the present specimen capsule location in the reactor vessel provides a neutron flux (E>1Mev) 2.4 times greater than the inside 1/4 wall thickness (1/4t) location of the reactor vessel beltline. Cycles 1 and 2 have accumulated 1.64 full power years (EFPY) of actual exposure for an equivalent capsule irradiation of

3.94 EFPY. Since Cycle 3 is planned for 292 EFPD (0.8 EFPY) of operation, there is ample margin between the present capsule irradiation of 3.94 EFPY and the 1/4t reactor vessel beltline irradiation at the end of Cycle 3 of 2.4 EFPY.

## Surveillance Holder Tube

The present condition of the Oconee 1 surveillance holder tubes has been reviewed. The loads on the tubes measured during hot functional testing are very low compared to the allowable loads. A comparison of these loads is provided in B&W Topical Report BAW-10039.[4] A fatigue evaluation has also been performed using the as-measured strains and appropriately conservative factors for the reduction in cross-sectional area and knotch effects associated with the wear sites. The results of this evaluation have concluded that the maximum alternating stress levels during continued operation are well below the high-cycle endurance limit for the 304 stainless steel material. Based on the large margins in the design and the results of the fatigue evaluation, the tubes are considered acceptable in their present condition for Cycle 3 operation with the surveillance capsules and push rod assemblies removed, and the spring-loaded retaining devices installed to provide proper holder tube restraint.

A failure of a holder tube at a location of deep penetration is considered unlikely due to the large margin in the design. Severance of the holder tube at the deep penetrations corresponding to the second and third spacer locations is extremely improbable. These holder tube locations are constrained by the shroud tube or journal bearing, respectively.

Failure of the holder tube at the penetration in the ogee bend at the location of the fourth spacer would allow the lower portion of the holder to oscillate on the hinged mounting brackets. If no action were taken, this could result in a portion of the holder tube eventually becoming loose. However, the loose parts monitor system installed in Oconee 1 will enable detection of noise of the magnitude associated with components of this size and location and would permit an orderly shutdown of the reactor.

## CONCLUSION

It is concluded that operation of Oconee 1 with the surveillance specimen capsules removed and the surveillance specimen capsule holder tubes restrained by the upper tube spring-loaded retaining device is acceptable during Cycle 3.

REFERENCES:


1. Reactor Vessel Material Surveillance Program, BAW-10006A, Revision 3, Babcock & Wilcox, January 1975.

2. Reactor Vessel Material Surveillance Program - Compliance with 10 CFR 50, Appendix H, for Oconee Class Reactors, BAW-10100A, Babcock & Wilcox, February 1975.

3. Analysts of Capsule OC1-F from Duke Power Company Oconee Unit 1 Reactor Vessel Materials Surveillance Program, BAW-1421, Revision 1, Babcock & Wilcox, September 1975.

4. Prototype Vibration Measurement Results for B&W's 177-Fuel-Assembly, Two-Loop Plant, BAW-10039, Babcock & Wilcox, April 1973.

4.2.10 For Unit 1, the provisions of Specification 4.2.9 will be revised prior to Cycle 4 operation due to operation during Cycle 3 with the reactor vessel surveillance specimens removed from the reactor vessel.

4.2.11 During the first two refueling periods, two reactor coolant system piping elbows shall be ultrasonically inspected along their longitudinal welds (4 inches beyond each side) for clad bonding and for cracks in both the clad and base metal. The elbows to be inspected are identified in B&W Report 1364 dated December 1970.

Bases

The surveillance program has been developed to comply with Section XI of the ASME Boiler and Pressure Vessel Code, Inservice Inspection of Nuclear Reactor Coolant Systems, 1970, including 1970 winter addenda, edition. The program places major emphasis on the area of highest stress concentrations and on areas where fast neutron irradiation might be sufficient to change material properties.

The reactor vessel specimen surveillance program for Unit 1 and Unit 2 is based on equivalent exposure times of 1.8, 19.8, 30.6 and 39.6 years. The contents of the different type of capsules are defined below.

| A Type | B Type |
|---|---|
| Weld Material | HAZ Material |
| HAZ Material | Baseline Material |
| Baseline Material | |

For Unit 3, the Reactor Vessel Surveillance Program is based on equivalent exposure times of 1.8, 13.3, 26.7, and 30.0 years. The specimens have been selected and fabricated as specified in ASTM-E-185-72.

Early inspection of Reactor Coolant System piping elbows is considered desirable in order to reconfirm the integrity of the carbon steel base metal when explosively clad with sensitized stainless steel. If no degradation is observed during the two annual inspections, surveillance requirements will revert to Section XI of the ASME Boiler and Pressure Vessel Code.