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GENERAL ELECTRIC BOILING WATER REACTOR RELOAD 1 LICENSING AMENDMENT FOR PEACH BOTTOM ATOMIC POWER STATION UNIT NO. 3 FAST SCRAM CONTROL ROD DRIVE SECOND SUPPLEMENT

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GENERAL ELECTRIC BOILING WATER REACTOR
RELOAD 1 LICENSING AMENDMENT
FOR PEACH BOTTOM ATOMIC POWER STATION
UNIT NO. 3

FAST SCRAM CONTROL ROD DRIVE
SECOND SUPPLEMENT

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1. INTRODUCTION

This second "Fast Scram Control Rod Drive" supplement to NEDO-21363 (Reference 5.1) provides information to support the second cycle of reactor operation for the FSCRD (S/N 7464). NEDO-21363-2 (Reference 5.2) described the first FSCRD (S/N 7067) and supported its installation and operation in the Peach Bottom 3 reactor during cycle 2. The first FSCRD was removed for inspection at the end of Peach Bottom 3 cycle 2 and replaced by FSCRD (S/N 7464) which is presently in operation during cycle 3.

The first FSCRD was disassembled and inspected. The purpose of this report is to provide the results of the inspection and to discuss some of the performance data that is presently available. The inspection results of FSCRD (S/N 7067) and safety evaluation provided in reference 5.2 demonstrate that continued operation of FSCRD (S/N 7464) during cycle 4 does not introduce an unreviewed safety question and has no effect on the parameters used in the Safety Analysis (reference 5.3). The intent of the FSCRD test program is to utilize the FSCRD for several additional cycles to accumulate long-range experience in the reactor environment. Safety evaluations in support of long-term operation will be provided as necessary for each reactor cycle.

This report provides the results of the inspection of the first FSCRD which, in addition to the simulated reactor environment test described in NEDO-21363-2 (Reference [illegible]), has had one cycle of actual reactor experience.

2. REPORT OF FINDINGS

2.1 RESULTS OF FSCRD POST CYCLE VISUAL INSPECTION AT PEACH BOTTOM 3 SITE

The FSCRD was removed from the core and disassembled for inspection on April 9, 1978. The individual pieces of the FSCRD were inspected for wear or any other unusual conditions. Results of the visual inspection were as follows:

1. All major threaded joints were found to be tightly engaged.

2. Spud - no unusual marks or changes noted, except for damage which occurred during the drive removal procedure.

3. Seals - For the following items, no unusual or abnormal conditions were found:

   a. Buffer piston ring - Seals moved in the groove with very slight drag which is an acceptable condition.

   b. Drive piston

   c. Collet seal rings

   d. Stop piston

4. Buffer spring - Slight wear marks on the O.D. as expected; however, no abnormality existed.

5. Impact surfaces - The following parts were also inspected for unexpected deformations.

   a. Buffer piston - found to be normal relative to expected condition on both sides of skirt.

   b. Stop piston - found to be normal relative to expected condition. Stop piston seal groove had very slight rust stain, which was easily wiped off. No corrosion was found in the I.D. No chipping was found in the nitrided surface adjacent to the impact surface.

   c. Piston head - found to be normal relative to its expected conditions.

6. Piston tube - No corrosion was found on the O.D. This included the nitride interface areas.

7. Index tube - corrosion product deposit was observed at the first notch from the bottom at the location of the collet fingers. The corrosion was wiped off. The same condition was found four notches from the top of the tube. No other evidence of corrosion product deposit on the index tube was found.

8. Collet fingers - No chipping was observed on the Colmonoy surfaces.

9. Guide cap - No chipping was observed on the nitrided surfaces.

10. Inner filter - No abnormal or unexpected conditions were observed. No damage or corrosion was observed.

11. Uncoupling rod - No abnormal or unexpected conditions were observed. No deformation of the flange was seen.

12. Buffer piston - found to be free from sticking and maintained full retraction capability when st oked with the drive piston.

13. No galling on either the buffer shaft threads (upper) or the piston head threads was noted.

2.2 RESULTS OF METALLOGRAPHIC EXAMINATION

The metallographic examination of various FSCRD parts, such as the index tube, piston tube, and the buffer components are currently in progress but are not expected to be completed until the end of 1979. Preliminary observations showed indications of shallow (<2 mils) intergranular attack (IGA) had occurred at the top threaded end of the index tube. The IGA occurred at a location near the pitch diameter which forms a geometric crevice with the mating spud threads. It was also observed that many of the IGA sites were associated with non-metallic inclusions.

The investigation is not yet completed; however, the following summary is provided of results found thus far:

- Seven instances of shallow Intergranular attack (IGA) were found on three of four sections taken 90° apart on the top end threads of the index tube.

- None of the observed IGA exceeded 0.002 inch, which compares favorably with the same observations on previous drives.

- No IGA was observed on the bottom end threads.

- The IGA occurred near the pitch line which is a geometric crevice caused by the mating thread.

- All instances occurred on the side of the thread where it is calculated there should exist a tensile bending stress of small magnitude.

- Many of the IGA sites are closely associated with non-metallic inclusions.

The indications found thus far are considered to be insignificant in the effect on the performance and structural integrity of the drive. Development tests conducted on pre-cracked, statically loaded fracture mechanics specimens of XM-19 composition in high oxygen environments showed that no crack growth occurred even at applied high stress intensities. Thus, it is concluded that the indications observed on the threads would not have undergone any further significant growth. No other indications, which would not be expected in the current control rod drive mechanism design, were found.

2.3 REPORT OF PERFORMANCE OF FSCRD

The first of two FSCRDs (S/N 7067) was subjected to one year (cycle 2) of continuous reactor operation before being replaced by the second FSCRD (S/N 7464). During this period, the drive performance was monitored.

Table 1 summarizes the recorded drive activities of FSCRD S/N 7067. The data showed no abnormality of drive functions (insert, withdraw, scram) during the cycle. Visual examination of the drive components at Peach Bottom 3 site on

April 1978 revealed no unusual conditions. Section 2.1 of this report describes the results of these examinations.

Table 1
SUMMARY OF RECORDED ACTIVITIES
FOR FSCRD S/N 7067

	Insert	Withdrawal	Scrams
Number of Operations			
February 77 to April 78	36	113	9

A sample of scram time test data for the first FSCRD mechanism is provided in Table 2.

Table 2
SCRAM TIME TEST
(Rod No. 26-23) (FIRST FSCRD) (SN 7067)
(Pr = 1000 psi)

Position Indicating Switch No.*	(4/1/77) Time (sec)
46DO	0.313
38PU	0.711
24PU	1.47
04PU	2.59

*PU = Pickup of position indicator switch
*DO = Dropout of position indicator switch

A summary of recorded drive activities during cycle 3 of FSCRD S/N 7464 is provided in Table 3.

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Table 3
SUMMARY OF RECORDED ACTIVITIES
FOR FSCRD S/N 7464

	Insert	Witndrawal	Scrams
Number of Operations April 1978 to May 1979	49	79	25

A sample of scram time test data for the second FSCRD mechanism is provided in Table 4.

Table 4
SCRAM TIME TEST
(ROD NO. 26-23) (SECOND FSCRD) SN 7464)
(Pr = 1000 psi)

Measured Times* and Data Tape Dates

Position Indicating Switch No.	6/29/78 to 9/8/78 (sec)	9/8/78 to 11/15/78 (sec)	1/15/79 to 2/13/79 (sec)
46 Do	0.270	0.330	0.290
38 Pu	0.672	0.810	0.730
24 Pu	1.470	1.610	1.500
04 Pu	2.560	2.730	2.660

*(From ADGS Recordings)

The scram times exhibited by these two FSCRD's are approximately the same as the average times of the present design. It was noted in NEDO-21363-2 (Reference 5.2) that although BWR/6 drive pressures (1200 psi) normally supplied by the BWR/6 Hydraulic Control Units (HCU's), would not be used in Peach Bottom 3, the N_2 precharge for FSCRD field evaluation would be increased from ~575 psi at 70°F to ~769 psi at 70°F in order to obtain a predominantly "accumulator

scram" rather than a "vessel scram." The accumulator pressure was inadvertantly reduced to the normal pressure during the course of the test; therefore, not all of the scram times reflect the increased accumulator pressure. However, all the scram times are in the expected range for the existing conditions.

3. SAFETY EVALUATION

NEDO-21363-2 (Reference 5.2) provided a safety evaluation of operation of Peach Bottom 3 with a FSCRD installed. The evaluation considered the three requirements of 10CFR50.59 and concluded that no unreviewed safety question was introduced by the FSCRD. This safety evaluation is also applicable for operation of the currently installed FSCRD (S/N 7464) during cycle 4 operation.

This report on the performance of the first FSCRD and the expected performance of the second FSCRD, S/N 7464 during its second cycle of operation in Peach Bottom 3 demonstrates that operation of FSCRD S/N 7464 during cycle 4 will not introduce an unreviewed safety question.

4. CONCLUSION

FSCRD S/N 7464 is expected to operate without introduction of an unreviewed safety question in Peach Bottom 3 during cycle 4. An evaluation supporting operation during future cycles will be provided prior to each additional cycle of operation.

5. REFERENCES

5.1 General Electric Boiling Water Reactor Reload 1 Licensing Amendment for Peach Bottom Atomic Power Station Unit Number 3, November 1976 (NEDO-21363).

5.2 General Electric Boiling Water Reactor Reload 1 Licensing Amendment for Peach Bottom Atomic Power Station Unit Number 3, Fast Scram Control Rod Drive Supplement, November 1976, (NEDO-21363-2).

5.3 General Electric Company Supplemental Reload Licensing Submittal for PBAPS Unit 3, July 1979 (NEDO-24204A).

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