



UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RESPONSE TO BULLETIN 95-02

TENNESSEE VALLEY AUTHORITY

BROWNS FERRY NUCLEAR PLANT UNITS 1, 2, AND 3

DOCKET NUMBERS 50-259, 50-260, AND 50-296

1.0 INTRODUCTION

On October 17, 1995, the NRC issued Bulletin (B) 95-02, "Unexpected Clogging of A Residual Heat Removal (RHR) Pump Strainer While Operating in Suppression Pool Cooling Mode." This bulletin was issued in response to an incident at the Limerick plant which revealed that inadequate suppression pool cleanliness can lead to unacceptable buildup of foreign material, debris, and corrosion products on the strainer during normal operation. This accumulation could degrade the ability of the emergency core cooling system (ECCS) to perform its design functions for accident conditions. B 95-02 specified actions boiling water reactor (BWR) licensees were requested to take to ensure ECCS operability during normal operation.

On November 15, 1995, the Tennessee Valley Authority (the licensee) submitted its response to B 95-02 for the Browns Ferry Nuclear Plant (BFN) Units 1, 2, and 3. On November 17, 1995, the licensee confirmed completion of short-term actions prior to the restart of BFN Unit 3 after its extended shutdown. The licensee provided supplemental information on March 5, 1996 based on telephone conferences with the NRC staff. The NRC staff evaluation of the information provided by the licensee is given below.

2.0 BACKGROUND

BFN Unit 1 remains in an extended shutdown. The licensee stated that appropriate actions to address B 95-02 will be taken prior to restart of this unit. The licensee stated that programs established to ensure ECCS pump operability for BFN Units 2 and 3 will apply to Unit 1 when that reactor is returned to service.

BFN Unit 2 was restarted in May 1991 after an extended recovery outage. During a refueling outage in the fall of 1994, the licensee inspected and cleaned this unit's suppression pool and ECCS suction strainers. The licensee does not plan to perform additional inspections prior to the next refueling outage, scheduled to start on March 22, 1996.

ENCLOSURE

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BFN Unit 3 restarted on November 19, 1995. This unit's suppression pool was visually inspected and cleaned prior to restart. The licensee also performed ECCS pump testing as part of its restart testing program. Debris found in the suppression pool was removed, and additional inspections and testing performed to ensure pump operability.

3.0 EVALUATION

The purpose of the requested actions in the bulletin is to ensure that ECCS and other pumps drawing suction from the suppression pool do not experience unacceptable buildup of debris that could clog strainers during normal operation which would prevent them from performing their safety function. Requested action 1 requested licensees to evaluate the operability of their pumps based on the cleanliness of the suppression pool and strainers. Requested action 2 requested a verification of the licensee's assessment through a pump test and strainer inspection. These two actions serve to ensure that the pumps are currently operable and not experiencing unacceptable debris buildup. Requested actions 3, 4 and 5 serve to ensure that appropriate measures are taken in the long term to prevent debris accumulation in the pool.

Each of the actions requested by B 95-02 is given below, with a summary and discussion of the licensee's response for that requested action.

3.1 Requested Action 1

Verify the operability of all pumps which draw suction from the suppression pool when performing their safety functions (e.g., ECCS, containment spray, etc.), based on an evaluation of suppression pool and suction strainer cleanliness conditions. This evaluation should be based on the pool and strainer conditions during the last inspection or cleaning and an assessment of the potential for the introduction of debris or other materials that could clog the strainers since the pool was last cleaned.

The BFN Unit 2 suppression pool and ECCS strainers were inspected during a refueling outage in October 1994. After finding some debris during this inspection, the licensee cleaned the suppression pool, removing debris and accumulated sludge.

The BFN Unit 3 suppression pool was drained, cleaned, and re-coated during the extended recovery outage. This pool was refilled with water in April 1995.

Subsequently, during Unit 3 core spray pump testing, the licensee discovered and removed foreign material consisting predominately of parts of a filter bag. After additional operation of the core spray and RHR pumps, the licensee found similar material on the ECCS strainers. As a result, the licensee decided to clean the suppression pool and ECCS strainers again, and to perform additional ECCS pump operability testing prior to BFN Unit 3 restart. Followup inspections by the licensee found the strainers and suppression pool

to be free of debris. Completion of these actions was documented in a letter submitted by the licensee on November 17, 1995, 2 days before BFN Unit 3 restart.

Based on the cleanings and inspections discussed above, the licensee has concluded that all pumps drawing suction from the suppression pool to perform their safety function are operable. The staff concurs that the inspections and cleanings of the BFN Units 2 and 3 suppression pools provide a reasonable basis for this conclusion.

3.2 Requested Action 2

The operability evaluation in requested action 1 above should be confirmed through appropriate test(s) and strainer inspection(s) within 120 days of the date of this bulletin.

BFN Unit 3 implemented this requested action by performing a test and inspection prior to restart. The results of the licensee's actions are discussed in its letter of November 17, 1995.

Based on operating experience, the licensee has decided not to perform a test of the ECCS pumps to verify operability for BFN Unit 2. The ECCS pumps were operated for significant periods of time during the current operating cycle. The RHR pumps were operated in excess of 178 hours in torus cooling mode during the current cycle. Table 1 provides data from the licensee's letter of March 5, 1996 on some of the more significant pump runs performed. This data indicates that on at least three occasions, the licensee conducted pump runs with two pumps operating for a period of time in excess of 3 hours in duration with flow rates of 12000 GPM. This flow rate and duration is equivalent to about 2.4 times the suppression pool water volume, or 2.4 pool turnovers. The licensee has concluded that these pump flows and system alignments are similar to those that would be present during operation in torus cooling mode after an abnormal event or transient. The licensee has also stated that the pump flows, system alignments, pool turnovers, and run times from these pump runs are comparable to what would be provided in a confirmatory test to verify pump operability, and that during these pump runs, there has been no indication of strainer blockage. Therefore, the licensee has concluded that an additional test of the ECCS pumps to verify operability is not necessary.

The licensee will conduct an inspection of the ECCS strainers during its upcoming Unit 2 refueling outage scheduled to start on March 22, 1996. This date is 37 days beyond the date requested in B 95-02; however, the licensee believes this additional operating period is justifiable because, as noted above, the BFN Unit 2 suppression pool was inspected and cleaned during the last refueling outage. In addition, surveillance testing of core spray and RHR pumps during the current operating cycle has not indicated ECCS strainer blockage. The foreign material exclusion program prevents foreign material from entering the suppression pool through interfacing systems.

The staff concludes that the licensee's pump operating experience during the current operating cycle provides an adequate basis to ensure the ECCS pumps

current operability without unacceptable strainer debris accumulation, and is an acceptable substitute for the requested test. The staff also finds the proposed additional operating period to be acceptable based on the torus and strainer cleanings performed during the 1994 BFN Unit 2 refueling outage, and the minimal potential to introduce additional debris during the current operating cycle. The licensee is requested to notify the NRC staff if BFN Unit 2 operation in the current fuel cycle is expected to continue after March 22, 1996.

The licensee completed the requested actions for BFN Unit 3 prior to restart, as noted in its letter of November 17, 1995.

DATE	PUMPS		FLOW (GPM)	DURATION (MINUTES)	POOL TURNOVERS
	RHR	CORE SPRAY			
12/5/94	2A		9000	366	3.43
	2C		9000	359	3.36
12/6/94	2A & 2C		12000	27	0.34
	2C		9000	345	3.25
12/30/94		2A	3125	20	0.07
		2C	3125	18	0.06
2/23/95	2B & 2D		12000	188	2.35
4/13/95		2B	3125	25	0.08
		2D	3125	23	0.08
9/8/95	2B & 2D		12000	196	2.45
12/2/95	2A & 2C		12000	196	2.48
2/23/96	2A & 2C		12000	134	1.68

Table 1. BFN Unit 2 Cycle 8 ECCS Pump Runs

3.3 Requested Action 3

Schedule a suppression pool cleaning. The schedule for cleaning the pool should be consistent with the operability evaluation in requested action 1 above. In addition, a program for periodic cleaning of the suppression pool should be established, including procedures for the cleaning of the pool, criteria for determining the appropriate cleaning frequency, and criteria for evaluating the adequacy of the pool cleanliness.

The NRC staff finds that the recent cleanings of the BFN Units 2 and 3 suppression pools, as discussed above, fulfills the initial scheduling request.

The licensee stated it would develop a suppression pool cleaning program, based on plant-specific and overall industry information. The licensee also committed to visually inspect the ECCS pump suction strainers during each refueling outage. The NRC staff accepts this response.

3.4 Requested Action 4

Review FME procedures and their implementation to determine whether adequate control of materials in the drywell, suppression pool, and systems that interface with the suppression pool exists. This review should determine if comprehensive FME controls have been established to prevent materials that could potentially impact ECCS operation from being introduced into the suppression pool, and whether workers are sufficiently aware of their responsibilities regarding FME. Any identified weaknesses should be corrected. In addition, the effectiveness of the FME controls since the last time the suppression pool was cleaned and the ECCS strainers inspected, and the impact that any weaknesses noted may have on the operability of the ECCS should be assessed.

The BFN Unit 2 suppression pool was inspected and verified to be free of foreign material prior to startup from the fall 1994 refueling outage. The BFN Unit 3 suppression pool was cleaned and inspected prior to startup from the extended shutdown in November 1995. Therefore, there is reasonable assurance that there is minimal foreign material within the pools that can adversely affect ECCS pump performance until the next refueling outage for each unit.

The licensee stated it is reviewing its FME program because of problems observed by the NRC (see inspection reports 50-259/50-260/50-296 94-27 and 95-51). The NRC will monitor the effectiveness of the licensee's program.

3.5 Requested Action 5

Consider additional measures such as suppression pool water sampling and trending of pump suction pressure to detect clogging of ECCS suction strainers.

In the short-term, the staff finds that since the suppression pools have been recently cleaned, there is reasonable assurance that ECCS pump operability will not be compromised by pump strainer blockage at BFN Units 2 and 3.

In the long-term, the licensee is participating in Boiling Water Reactors Owners Group activities to identify additional measures to avoid ECCS pump strainer blockage. The NRC staff will monitor the results and implementation of these activities. The licensee's response is acceptable.

3.6 BFN Unit 1

Since BFN Unit 1 is in an extended shutdown, no short-term action to respond to B 95-02 is necessary for this reactor. The licensee has committed to

implement programs instituted to assure the operability of the BFN Units 2 and 3 ECCS to Unit 1 when that reactor is returned to service. The NRC staff finds this commitment acceptable.

4.0 SUMMARY

As discussed above, the NRC staff has found that the licensee has adequately responded to B 95-02 for BFN Units 1, 2, and 3. The licensee is requested to inform the staff if the start of the BFN Unit 2 refueling outage is postponed beyond March 22, 1996. In accordance with the reporting requirements of B 95-02, the licensee should submit results of their strainer and suppression pool inspections for the upcoming BFN Unit 2 refueling outage within 10 days of completing that inspection.

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Dated: March 14, 1996