



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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NO. 204 TO FACILITY OPERATING LICENSE NO. DPR-33

AMENDMENT NO. 223 TO FACILITY OPERATING LICENSE NO. DPR-52

AMENDMENT NO. 177 TO FACILITY OPERATING LICENSE NO. DPR-68

TENNESSEE VALLEY AUTHORITY

BROWNS FERRY NUCLEAR PLANT, UNITS 1, 2, AND 3

DOCKET NOS. 50-259, 50-260 AND 50-296

1.0 INTRODUCTION

By letter dated December 23, 1992, and supplemented August 12, 1993 and January 21, 1994, the Tennessee Valley Authority (the licensee) submitted a request for changes to the technical specifications for the Browns Ferry Nuclear Plant (BFN) Units 1, 2, and 3. The requested changes would revise operability requirements for the Residual Heat Removal (RHR) system operating in the Low Pressure Coolant Injection (LPCI) mode for low pressure and temperature conditions. The proposed changes permit an RHR loop to be considered operable for LPCI if it can be manually realigned and is not otherwise inoperable.

The NRC staff requested additional information regarding this proposed change in a letter dated June 9, 1993. On August 12, 1993, the licensee responded to this request. The licensee also provided additional information in a letter dated January 21, 1994. The additional information provided in these letters is within the scope of the staff's proposed finding of no significant hazards considerations. Therefore, the staff's proposed finding of no significant hazards considerations remains valid.

2.0 EVALUATION

2.1 Background

On two occasions during BFN Unit 2 Cycle 6 operations (February 25, 1992 and September 28, 1992), the licensee requested temporary waivers of compliance from requirements of technical specification Limiting Conditions for Operation (LCO) 3.5.B.9. This specification requires, in part, two RHR pumps in one loop, or one RHR pump in each of two loops, to be operable in LPCI mode when the reactor system pressure is atmospheric and there is fuel in the core. On the first occasion, the licensee needed to repair a leaking RHR valve. In the second case, a similar situation arose when the licensee identified a leaking 3/4-inch RHR test line requiring repair. However, these repairs would render one RHR loop inoperable while the other RHR loop would be required to operate in shutdown cooling (SDC) mode. Therefore, the RHR system would be unable to automatically operate in the LPCI mode, and LCO 3.5.B.9 could not be

9404220241 940419  
PDR ADOCK 05000259  
P PDR



satisfied. The waivers were granted by the staff, as documented in letters dated February 26 and September 28, 1992.

To avoid similar problems in the future, the licensee committed to submit a request to revise the technical specifications, clarifying the RHR functional requirements. The submittal of December 23, 1992 fulfilled this commitment.

## 2.2 Discussion

Appendix A to 10 CFR Part 50 defines General Design Criteria for nuclear power plants. Criterion 35 requires an emergency core cooling system (ECCS) which is capable of transferring heat from the reactor core following any loss of coolant accident at a rate sufficient to prevent fuel and cladding damage and limit metal-water reactions to negligible amounts. The ECCS is also required to be able to perform its function, assuming a single failure and a loss of offsite power.

The changes requested by the licensee consist of revisions to LCO 3.5.B, "Residual Heat Removal System (RHRS) (LPCI and Containment Cooling)." A footnote is proposed to be added to LCO 3.5.B.1, stating that:

Low pressure coolant injection (LPCI) may be considered OPERABLE during alignment and operation for shutdown cooling with reactor steam dome pressure less than 105 psig in HOT SHUTDOWN, if capable of being manually realigned and not otherwise inoperable.

Similar wording is proposed to be added to LCO 3.5.B.9, which applies when reactor vessel pressure is atmospheric, and irradiated fuel is in the reactor vessel.

The current BFN technical specifications also include requirements for the operability of the core spray system (CSS). The CSS and the RHR system are the two safety-grade cooling water sources if the reactor coolant inventory is reduced by a postulated accident during hot shutdown or cold shutdown conditions. LCO 3.5.A.1 requires the two CSS loops to be operable with fuel in the core when reactor vessel pressure is greater than atmospheric pressure, except as specified by LCO 3.5.A.2, which allows continued operation for up to 7 days with one CSS loop inoperable. LCO 3.5.A.4 requires one operable CSS loop when reactor vessel pressure is atmospheric. These requirements are not affected by the proposed amendment.

When the reactor system is pressurized between atmospheric pressure and 105 psig, the proposed amendment, combined with existing CSS requirements, requires that at least four RHR pumps (per LCO 3.5.B.1) and four core spray pumps (per LCO 3.5.A.1) are operable. These specifications also require the diesel generators associated with these pumps to be operable. The proposed amendment extends the definition of operable RHR pumps for LPCI to allow alignment of these pumps for shutdown cooling.

The proposed change to LCO 3.5.B.1 applies only in hot shutdown, so the reactor will be subcritical with the mode switch in shutdown. Therefore, core heat generation is limited to decay heat generated by the irradiated fuel.

The required combination of pumps and diesel generators for this condition ensures, assuming the worst single failure, that at least one CSS pump will be available for automatic coolant injection for a postulated loss of coolant accident. One CSS pump provides sufficient flow to assure core cooling for this operating condition. No operator action is required to mitigate this event. Therefore, the requirements of General Design Criterion 35 are satisfied, and the proposed change to LCO 3.5.B.1 is acceptable.

When the reactor system is at atmospheric pressure, the proposed amendment for LPCI operability, combined with existing CSS requirements, ensures that at least two RHR pumps (per LCO 3.5.B.9) and one core spray pump (per LCO 3.5.A.4) are operable. Under the proposed amendment, the RHR pumps may be operating in SDC mode. These specifications also require the diesel generators associated with these pumps to be operable. In this mode, the limiting event is a postulated inadvertent draindown of the reactor coolant system. The licensee stated in its letter of August 12, 1993, that upon receipt of the reactor vessel low water level scram/isolation signal, operators are assumed to begin manually realigning the available RHR system to LPCI mode. This realignment is expected to take about 3.5 minutes. Once complete, this system is available for automatic injection if reactor vessel level decreases to the initiation setpoint, or for manual initiation in accordance with the BFN Emergency Operating Instructions.

The licensee also stated that the reactor draindown would be terminated by operation of the SDC isolation valves upon reaching the primary containment isolation system (PCIS) isolation setpoint based upon reactor water level. However, PCIS is not required to be operable for these conditions, and so should not be credited to terminate the draindown. Therefore, the licensee was requested to provide information describing the interlocks which preclude large drainage paths, and to demonstrate that small drainage paths cannot uncover the reactor fuel before the operator can realign the RHR system to LPCI mode.

Information describing the interlocks and the time to drain the reactor for various drain path sizes was provided in the licensee's letter of January 21, 1994. The licensee described three paths which credit interlocks to preclude draining the reactor vessel. These paths are summarized as follows:

1. If an RHR SDC pump suction valve is open, the suppression pool suction valve for that same pump cannot be opened.
2. If an RHR SDC pump suction valve is open, the corresponding RHR suppression pool return line valve cannot be opened. This interlock is presently installed on BFN Unit 2. TVA has committed to install the interlocks on BFN Units 1 and 3 before these reactors restart.
3. Operating procedures require the reactor operator to bypass the minimum flow logic for the RHR minimum flow valve prior to placing RHR in SDC mode, ensuring that this path is not available for reactor vessel drainage when the RHR pumps are operating in SDC mode. The RHR minimum flow valves are also interlocked to close if a SDC suction valve is not fully closed, and neither pump on the

corresponding loop is operating. This interlock prevents passive drainage of the reactor vessel when the RHR pumps are idle.

The licensee's letter of January 21, 1994 states that the other potential drainage paths are small (no larger than one-inch). The licensee presented results of calculations which show that the time required to drain the reactor vessel to the top of active fuel for these small paths (over 30 minutes) is much longer than the time required for manual realignment of RHR to LPCI mode (approximately 3.5 minutes).

The staff finds that the licensee has demonstrated that the large reactor drain paths are adequately controlled by procedures and electrical interlocks to preclude loss of reactor coolant through these paths. The staff also finds that the licensee has demonstrated that the remaining leak paths cannot uncover the fuel before the operator can complete realignment of the RHR system from SDC to LPCI mode; therefore, manual operator action to perform this realignment is an adequate substitute for automatic RHR initiation in LPCI mode. If a single-failure of the RHR system is postulated, the core can be kept covered by the independent core spray pump required by LCO 3.5.A.4. Therefore, the proposed change to LCO 3.5.B.9 satisfies GDC 35 and is acceptable.

Since the discussion above relies upon interlocks to prevent large drainage paths from the reactor vessel, the staff expects these interlocks to be installed before fuel is loaded in BFN Units 1 and 3. This expectation is consistent with TVA's January 21, 1994 commitment to install the interlocks prior to restart of BFN Units 1 and 3.

### 2.3 Summary

The licensee has proposed changes to residual heat removal system requirements for low pressure coolant injection capability for shutdown conditions. The proposed changes ensure that the requirements for single-failure tolerant core cooling given by General Design Criterion 35 are maintained. Therefore, the proposed changes are acceptable.

### 3.0 STATE CONSULTATION

In accordance with the Commission's regulations, the Alabama State official was notified of the proposed issuance of the amendment. The State official had no comments.

### 4.0 ENVIRONMENTAL CONSIDERATION

The amendments change requirements with respect to installation or use of a facility component located within the restricted area as defined in 10 CFR Part 20. The NRC staff has determined that the amendments involve no significant increase in the amounts, and no significant change in the types, of any effluents that may be released offsite, and that there is no significant increase in individual or cumulative occupational radiation exposure. The Commission has previously issued a proposed finding that the amendments involve no significant hazards consideration, and there has been no



10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60  
61  
62  
63  
64  
65  
66  
67  
68  
69  
70  
71  
72  
73  
74  
75  
76  
77  
78  
79  
80  
81  
82  
83  
84  
85  
86  
87  
88  
89  
90  
91  
92  
93  
94  
95  
96  
97  
98  
99  
100

public comment on such finding (58 FR 16873). Accordingly, the amendments meet the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9). Pursuant to 10 CFR 51.22(b) no environmental impact statement or environmental assessment need be prepared in connection with the issuance of the amendments.

#### 5.0 CONCLUSION

The Commission has concluded, based on the considerations discussed above, that: (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, (2) such activities will be conducted in compliance with the Commission's regulations, and (3) the issuance of the amendments will not be inimical to the common defense and security or to the health and safety of the public.

Principal Contributor: Joseph F. Williams

Date: April 19, 1994



10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60  
61  
62  
63  
64  
65  
66  
67  
68  
69  
70  
71  
72  
73  
74  
75  
76  
77  
78  
79  
80  
81  
82  
83  
84  
85  
86  
87  
88  
89  
90  
91  
92  
93  
94  
95  
96  
97  
98  
99  
100