Florida Power
CORPORATION

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U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, D.C. 20555

Subject: Crystal River Unit 3
Docket No. 50-302
Operating License No. DPR-72
Reactor Building Flooding
Supplement 3

Reference:
A. FPC LER 90-005, dated April 29, 1990
B. FPC Letter, Reactor Building Flooding, dated May 17, 1990
C. FPC Letter, Supplemental Information on Reactor Building Flooding, dated June 4, 1990
D. FPC Letter, Reactor Building Flood Supplement 2, dated June 12, 1990

Dear Sir:

The purpose of this letter is to provide additional detail on a design basis issue related to the Reactor Building (RB) maximum accident flood level and the resolutions which Florida Power Corporation (FPC) has implemented as an interim solution. On March 29, 1990, Florida Power Corporation (FPC) determined that Crystal River Unit 3 (CR-3) was operating outside the plant design basis due to procedures which were based upon a non-conservative Reactor Building (RB) maximum accident flood level calculation. This problem is described in References A through D. This letter supersedes Reference D in its entirety.

RB Flood Level Issue

The Borated Water Storage Tank (BWST) is the primary source of ECCS water to mitigate design basis accidents. During the initial phase of LOCA mitigation, the BWST provides the source of water for the High Pressure Injection (HPI), Low Pressure Injection (LPI), and

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Building Spray (BS) pumps to inject water into the reactor vessel and spray into the RB atmosphere. The water inventory from the reactor coolant system, the BWST, and the other tanks (Core Flood Tank, Makeup Tank, and Sodium Hydroxide Tank) fall to the RB floor, eventually reaching the RB sump located in the 95 ft floor elevation (plant datum). The sump will eventually fill and the lower elevations of the RB will flood. In accordance with the current emergency operating procedures, when the BWST level reaches 4 ft, the operator manually transfers the LPI and BS pump suctions from the BWST to the RB sump, initiating the recirculation phase. Recently, the calculations for the maximum accident flood level have been revised due to discrepancies identified during our Configuration Management efforts. The results indicate a RB flood level of approximately 102 ft elevation. This level is based on maximum Technical Specification volumes in the various tanks at the beginning of the accident. A number of instruments necessary to mitigate the design basis accidents are installed on the walls below the 102 ft elevation, but above the 99.85 ft elevation (the maximum flood level described in FSAR Section 6.2.2.1). A list of these instruments is provided in Reference A. Thus, a design basis accident could cause these instruments to be submerged. It is, therefore, necessary to limit the flood level to the FSAR value of 99.85 ft elevation as an interim solution to the issue.

To limit the flood level, there are four related considerations which FPC addressed in its development of the interim solution. These are:

a. Water volumes and boron concentrations for core cooling and shutdown requirements must be satisfied,

b. Minimum required NPSH of the LPI and BS pumps must be satisfied before switchover to RB sump suction,

c. Materials inside the RB must be compatible with the pH of the RB spray or sump fluid, and

d. Main Control Room thyroid dose limit must not be exceeded.

The licensing bases LOCA models address the first consideration and limit the minimum volume of water and boron concentration in the BWST. The required levels for the LPI pumps and the BS pumps NPSH are 95.6 ft and 97.0 ft, respectively. Maintenance of the expected pH in the range of 7.2 to 11.0 by establishing a proper balance of sodium hydroxide and borated water will assure material compatibility including components that will be wetted by the RB spray. A limited duration excursion above a pH of 11.0 is verified to be acceptable in our EQ program documentation. Large break LOCA (LBLOCA) pH control is not a concern at CR-3 and the present plant

configuration provides adequate protection. A discussion of small break LOCA (SBLOCA) pH effects and Main Control Room thyroid dose is presented below.

Operator Action To Limit RB Flood Level

The approach which resolves the RB flooding issue on an interim basis is to limit the volume of water contributed by the BWST. This will be accomplished by a procedural change in operator action. The operator will ensure the RB flood level will not exceed the 99.85 ft elevation. Following a LOCA, by procedure the operator will begin manual transfer of the ECCS pump suctions from the BWST to the RB sump when the RB flood level reaches the 97.6 ft elevation (this level includes an allowance for instrumentation error and occurs later than 10 minutes into the event). In addition, an alarm will be received in the control room when the RB flood level reaches approximately 97.6 ft. The corresponding actual level will satisfy the ECCS pump NPSH, core cooling, shutdown, and pH requirements. The RB flood level will be less than 99.85 ft when the switchover from the BWST to the RB sump is completed even under worst case large break LOCA flow rates. FPC has confirmed that this switchover can be accomplished in sufficient time (see discussion below). This action will assure that all equipment and instrumentation necessary to mitigate a LOCA remain operable.

However, there is a decreased operator response time to complete the switchover to suction from the RB sump under this interim solution. Under the previous approach (initiation of switchover to RB sump based upon BWST level), the operator was not required to complete switchover prior to approximately 30 minutes into the event (prior to ECCS pumps losing suction as a result of the BWST being emptied). The interim strategy will require the operator to complete the switchover approximately 20 minutes into the event to preclude instrument flooding. FPC considers our interim strategy to be acceptable for the following reasons:

a. Even under large break LOCA conditions the operator will not be called upon for at least 10 minutes; well after the immediate EOP steps have been completed.

b. The operator has more than 10 minutes after receiving the alarm to complete the switchover before reaching a flood level that would cover instruments.

c. The switchover actions took approximately 5 to 7 minutes during plant specific simulator runs by two operators. These action times were achieved under simulated full large break LOCA injection and spray flow rates.

d. The possibility of a large break LOCA at CR-3 is extremely remote. FPC has an exemption from 10 CFR 50, Appendix A, GDC 4-Environmental and Dynamic Effects Design Bases for large bore snubber removal based on Leak Before Break Technology. This exemption takes credit for the ability to detect a leak prior to the occurrence of a large break LOCA.

e. Smaller break sizes allow substantially longer time [illegible] before operator action is required and for the operator to perform the switchover. Thus, realistic scenarios would result in little change in operator [illegible]en.

Permanent solutions to the RB flooding issue will return the time required for the operator's actions for all break scenarios to previous values.

An assessment of the RB flood level instrumentation reliability was performed due to the increased significance for this interim approach to limiting RB flood level. Both BWST and RB Flood Level variables are monitored by Regulatory Guide 1.97 Category 1 instrument strings. The RB Flood Level will be reclassified to a Type A variable instead of Type B. Current CR-3 Technical Specifications already establish controls for this and other Type variables consistent with current staff positions. Thus, FPC considers the reliability and control of the instrumentation to be appropriate.

pH Condition

FPC's evaluation of the RB flood scenarios identified a possible unanalyzed pH condition which results from a SBLOCA creating different BWST and Sodium Hydroxide (NaOH) Tank drawdown rates than were assumed for LBLOCAs. The drawdown rates of liquid from the BWST and the NaOH Tank are functions of the hydraulic conditions for each tank. A LBLOCA at CR-3 will actuate the Reactor Building Spray (BS) System on a high RB pressure of 30 psig. The CR-3 drawdown analysis presently used by the B&W Nuclear Services (BWNS) Company assumes that the BWST and the NaOH Tank drawdown at the flow rates necessary to mitigate a SBLOCA. Depending upon the break size, a SBLOCA may not actuate the BS System until some time after the break occurs. This delay in actuation of the BS System could create a difference in the relationship of the hydraulic heads on the BWST and NaOH Tank. Consequently, the drawdown rates could be different from those assumed in the LBLOCA and the resultant spray pH as a function of time is not completely defined, This lack of clearly defined spray pH range is being evaluated by FPC under the appropriate reporting requirements. FPC has discussed this situation with the BWNS Company and the B&W Owners

Group, and the lack of SBLOCA pH calculations could be a generic PWR problem. Conversely, this situation may not be part of licensing or design bases. This concern may be eliminated by the installation of tri-sodium phosphate (TSP) stored in baskets located in the RB sump. This solution to long term pH control with a SBLOCA (or LBLOCA) as the initiating event is possible since the dilution of the TSP by the borated water from all sources will establish proper pH balance. This approach has been implemented by Toledo Edison's Davis-Besse plant. The NaOH Tank and its contents would no longer be necessary to perform an accident mitigating function. FPC is evaluating this approach as a resolution to the pH concern. (Note that this issue is independent of the RB flooding problem and is included here for information only).

Main Control Room Thyroid Dose

The doses prescribed by 10 CFR 50, Appendix A, GDC 19-Control Room, are 5 rem whole body, or its equivalent to any part of the body. Although CR-3 was not reviewed against the Standard Review Plans, FPC considered SRP 6.4, "Control Room Habitability System," and SRP 15.6.5, Appendix B, "Radiological Consequences of a Design Basis Loss-of-Coolant Accident: Leakage form Engineered Safety Feature Components Outside Containment," as guidelines to develop the Control Room Habitability Study submitted by FPC's letter dated June 30, 1987. SRP 6.4 suggests a thyroid dose limit of 30 rem to assure that the GDC 19 limit is met. The 30-day control room thyroid dose given in the Control Room Habitability Study submitted in FPC's letter dated June 30, 1987 is 26.5 rem.

Using the SRPs as guidance, the Control Room Habitability Study assumed a gross failure of a passive component which causes a 50 gpm leak for 30 minutes at 24 hours since the plant design does not provide for an Engineered Safety Features (ESF) filtration system. This assumption is very conservative since CR-3 has a non-safety grade filtration system associated with the areas containing the ESF systems and passive failures were not considered as part of the CR-3 licensing basis.

A main control room dose analysis was performed to evaluate the effect of less water volume (thus, higher iodine concentration) in the RB under the revised flood level strategy. Using the same assumptions as the Control Room Habitability Study, this evaluation yielded a 30 day Control Room thyroid dose of 38.6 rem. Another analysis was then performed which includes partial credit for the non-safety grade filtration system. This calculation was performed and used the following assumptions:

1. Operational leakage 4510 cc/hr,

2. 50 gpm leak for 30 minutes at 24 hours after the accident, and

3. Auxiliary Building Ventilation System in service with 75% efficient charcoal filters for iodine.

Assumptions 1 and 2 follow the SRP guidelines. Assumption 3 is considered a reasonable value for the filtration system although it is not fully safety grade (i.e., Regulatory Guide 1.52, Revision 2 allows a 95% filter efficiency assumption for a charcoal filter with a 2 inch bed depth designed to operate outside the reactor building). The resulting 30 day thyroid dose using these assumptions is 25.6 rem which is below the SRP 6.4 recommended limit. FPC considers this evaluation an adequate demonstration that acceptable dose levels can be maintained in the Main Control Room.

Summary

In summary, FPC has performed, or will take, the following actions to assure CR-3 can use operator actions as an interim solution to the RB flooding issue:

1. Safety evaluations in accordance with 10 CFR 50.59 have been performed on the modification and procedure changes to insure that an unreviewed safety question has not been created by the change in operator action. These safety evaluations have been reviewed by the Plant Review Committee (PRC). There are no unresolved safety issues.

2. Operational procedures have been revised and issued. Operator training on the use of the RB flood level as the new switchover parameter has been completed.

3. A modification has been installed to add an alarm in the Main Control Room to indicate when the RB flood level has reached the point that operator action to initiate switchover from the BWST to the sump has to begin. The instrumentation that mitigates this alarm will be reclassified as a Type A variable.

4. Although removal of the Auxiliary Building Ventilation System from CR-3 Technical Specifications is planned as part of our Technical Specification Improvement Program effort, the limiting conditions of the current CR-3 Technical Specification 3/4.7.8 for the Auxiliary Building Ventilation System will continue to be met until a permanent resolution of the RB flooding issue is achieved.

FPC is currently evaluating options for the permanent resolution of this issue. The most probable fix is to relocate the RB instrumentation and equipment to an elevation higher than 102 ft. This solution would permit increased water volume and maximum operator response time. Resolution of this issue will be achieved by the end of Refuel 8 (subject to material delivery). FPC will inform the NRC by October 1, 1990 of the details of the permanent fix. FPC will also provide quarterly updates on our efforts to resolve this issue and seek NRC approval for any schedule changes. We appreciate the staff's efforts in promptly reviewing this issue.

Sincerely,

P. M. Beard, Jr.
Senior Vice President
Nuclear Operations

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xc: Regional Administrator, Region II
Senior Resident Inspector