

**Florida
Power**
CORPORATION

October 29, 1985
3F1085-14

Mr. Harold R. Denton, Director
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Subject: Crystal River Unit 3
Docket No. 50-302
Operating License No. DPR-72
Emergency Feedwater System Reliability

Dear Sir:

The purpose of this letter is to provide the NRC with a documented summary of programs and improvements involving the Emergency Feedwater (EFW) System for Crystal River Unit 3 (CR-3).

Florida Power Corporation (FPC) shares the concern and interest the NRC has in its current review of Emergency Feedwater Systems because of recent industry events. FPC has been very active in improving its own EFW system and wants to illustrate the improvements which have been made, the actions that have been planned, and discuss our own assessment of the reliability of the CR-3 EFW system.

It should be noted that in our analysis and evaluation of the EFW, we have also identified many other support or primary systems that we consider to have equal importance. FPC is reviewing main feedwater reliability history in order to preclude demands on EFW when main feedwater trips occur. Other support systems for assuring adequate core cooling include CR-3's ability to use the "feed & bleed" method with great success. The use of high pressure injection pumps for feed and bleed cooling of the core has been successfully tested at the Once Through Integral System (OTIS) facility and during our transient of February 26, 1980. FPC believes that this procedure provides a major increase in our core cooling ability.

Florida Power Corporation is dedicated and concerned. We are determined to provide the necessary safety system reliability to assure that the health and safety of the public are maintained. We believe our program for maintaining and enhancing the CR-3 EFW and associated systems is achieving this goal.

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The following is a brief synopsis of the background, modifications, maintenance practices, Owners Group activities, and recent analysis methods developed to enhance CR-3's EFW system.

BACKGROUND

The initial requirements for modifications to the EFW system were a direct result of NRC response to the accident at TMI and the subsequent publication of NUREG-0737. In addition to the requirement for certain EFW hardware modifications, there was also a requirement for an EFW system reliability study. FPC's response was in the form of BAW-1584, "Auxiliary Feedwater System Reliability Analysis", published in December 1979. This study used the data and assumptions set forth in NUREG-0611 and 0635. It is now obsolete due to the modifications which have been implemented at CR-3. In June 1981, B&W completed a new EFW reliability study for FPC. It was entitled "EFW System Upgrade Reliability Analysis for CR-3", and took into account committed modifications, the dominant one being the Emergency Feedwater Initiation and Control System (EFIC). The study used industry-representative failure rates and actual human reliability analyses for key operator actions. This study was sent to NRC and reviewed by Brookhaven National Laboratories (BNL). BNL's review was essentially a re-analysis using the NUREG-0611 data and assumptions, allowing no credit for EFIC. FPC does not believe the BNL review reflects the true reliability of the CR-3 EFW system. As a result, an updated EFW reliability study is being performed in conjunction with the CR-3 Probabilistic Risk Assessment (PRA) project now underway at FPC.

EMERGENCY FEEDWATER/PRA RE-ANALYSIS

The new EFW study utilizes plant-specific data and takes into account all of the modifications to the system. Preliminary results indicate an EFW system unreliability of 1.7×10^{-4} for a Loss of Main Feedwater event. The potential exists for improvement through increased attention to the reliability of the turbine-driven EFW pump. The study will be completed by November 30, 1985.

FPC is currently in the final stages of a state-of-the-art Level 1 PRA. We have contacted Science Applications International Corporation (SAIC) to perform the analysis. SAIC has considerable PRA experience and has participated in several B&W plant PRAs including the CR-3 IREP study. Motivation for this project was provided by a desire for a replacement for the outdated CR-3 IREP study and a recognition of the increased NRC emphasis on probabilistic analysis. The new CR-3 PRA utilizes plant-specific data gathered from six years of maintenance records. FPC plans to use the PRA to evaluate the present CR-3 design and to analyze/prioritize proposed modifications. The PRA is expected to be completed by early 1986, and will also be used to determine the importance of the EFW system to the core melt frequency.

EMERGENCY FEEDWATER SYSTEM MODIFICATIONS

Over the past several years, numerous modifications have been made to improve the reliability of the Emergency Feedwater System. The most significant of these

modifications was the installation of a safety grade Emergency Feedwater Initiation and Control System. This system, required by NUREG-0737, Item II.E.1.1, cost over \$10 million. Other modifications to the EFW System were made to meet the requirements of 10 CFR 50, Appendix R. System enhancements include removal of pump suction valve internals to prevent a single failure from isolating the water source, installation of a parallel steam isolation valve to the EFW pump turbine, addition of supports to assure seismic adequacy, installation of environmentally qualified equipment, as necessary, to assure proper post accident performance, and locking open and lifting the leads of all AC operated valves to prevent spurious operation. During the next refueling outage, a dedicated EFW tank will be added which will be tornado and flood protected. This new tank will also have full safety grade redundant instrumentation. Special evaluations have been performed which assured no missile from the EFW turbine could jeopardize other necessary EFW system equipment. In all, the modifications and studies involved the expenditure of more than \$16 million. Attachment 1 describes the changes and modifications in more detail.

EMERGENCY FEEDWATER SYSTEM MAINTENANCE IMPROVEMENT

The Crystal River Unit 3 EFW maintenance program has been enhanced to provide a high degree of assurance that the system will operate when required. In our efforts to enhance the maintenance program, three different areas were evaluated; namely, equipment modification, maintenance programs (including inservice inspections), and operational programs.

Equipment modifications were performed to improve the system reliability which included the addition of a parallel steam admission valve to the turbine driven EFW pump and the addition of steam traps and pipe restraints. The parallel valve was installed for single active component failure protection. The steam traps and high energy line pipe restraints were installed to permit steam to be maintained to the steam admission valve thus precluding a slug of condensate from causing an overspeed trip of the turbine driven EFW pump. A modification was also made to the turbine driven EFW pump to provide pump bearing cooling from a stage of the pump discharge thereby providing simplified maintenance and deleting the dependence for cooling water from another system. A new type insulation (remap) is now being used so that its removal requires less time.

The preventative maintenance program was enhanced to improve reliability by several means. An oil analysis/change program for the emergency feedwater pump turbine governor was implemented as a result of past governor problems. This program has resulted in improved governor reliability. The Plant Maintenance Department has established a maintenance history from work requests for trending purposes. Specialists are utilized to perform monthly vibration checks on both the motor driven and turbine driven emergency feedwater pumps. Specialists are also utilized to perform periodic infrared scans of the switchgear to locate hot

spots and/or loose connections. A surveillance is performed monthly to monitor the flow characteristics of the EFW pumps and to demonstrate the operability of the EFW system. The motor operated valve analysis and testing system (MOVATS) is used periodically to test the limit switch operation and measure the torque on the torque switches for all motor operated valves in the EFW system. Inservice inspections are performed in accordance with the applicable code requirements except where specific exemptions were granted.

CR-3 plant policy states that specific equipment requiring maintenance, which includes the EFW equipment, must be worked around-the-clock, seven days a week until the system is restored to operable status.

OWNERS GROUP ACTIVITIES

FPC, along with the other members of the B&W Owners Group, is aggressively participating in the study and analysis of the June 9, 1985 transient at the Davis Besse Nuclear Power Plant. An Owners Group Task Force was formed to review the Davis-Besse course of action and determine which corrective actions should be generic to all B&W plants. This review resulted in a number of specific action items to be evaluated and reported on by each plant. The Task Force will review these reports to determine what further actions should be taken.

Another subcommittee of the Owners Group is reviewing reactor trips at B&W plants to determine actions that can be taken to reduce the reactor trip frequency. The Main Feedwater System is receiving a large portion of the subcommittee's attention since it has contributed to such a large portion of the reactor trips in the past. Improvements in the Main Feedwater System could significantly reduce the number of challenges to the Emergency Feedwater System as well as improve plant availability.

FPC also has an internal trip reduction task force which has reviewed Main Feedwater System operation. This task force has reviewed the INPO Good Practice for trip reduction and assured that FPC complies wherever possible. The task force has also made several recommendations for plant modifications and reviewed other modifications to assess trip potential.

CONCLUSION

Based on the information presented, Florida Power Corporation firmly believes the enhancements performed and the work under way are providing us with a highly reliable EFW system.

FPC has installed systems that can automatically start and control our EFW system yet prevent over-cooling. FPC has reduced failure possibilities by removing valve internals; increasing preventative and predictive maintenance; providing an intensive monitoring program including MOVATS, infrared scanning, vibration and lube oil monitoring; and by performing frequent functional testing.

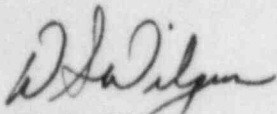
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As indicated by our PRA and analytical study of the CR-3 EFW system, the reliability of the system is high and provides adequate assurance that a core melt will not occur. The ability to perform feed and bleed as a backup to our EFW system is an added benefit that requires consideration.

Our management has been heavily involved in assuring we continue to improve our EFW system reliability and we have worked closely with the NRC in developing those enhancements that will best benefit our EFW system.

Our goals include continued evaluation and improvements in not only the EFW system but also in other support or companion systems, such as the Main Feedwater System. Our work with the other B&W owners is escalating on these efforts and should provide even higher plant reliability in the future. Please review the progress we have made and provide us with your comments.

Sincerely,



W. S. Wilgus
Vice President
Nuclear Operations

GRW/feb

Attachment

EFW PROGRAM

POST TMI EMERGENCY FEEDWATER SYSTEM UPGRADES

A. ORIGINAL AUXILIARY FEEDWATER SYSTEM

- Non Safety Related
- Seismic Piping Design
- Electrical Circuits and Components not seismically designed

B. SOURCES OF REQUIREMENTS

1. NUREG-0737 (TMI LESSONS LEARNED) 10/31/80
 - Item II.E.1.1 (EFW System Evaluation/Reliability Study)
 - Item II.E.1.2 (EFIC)
2. Generic Letter 81-14 (Seismic Review) 2/10/81
3. IREP (CR-3 Safety Study)
4. Interfaces
 - Fire Protection Program 10CFR50 Appendix "R"
 - Equipment Qualification Program 10CFR50.49

C. COMPLETED PROJECTS

1. EFIC

Description: Emergency Feedwater System Automatic Initiation and Flow Control. This was a complete new EFW Initiation and Control system fully safety grade. The new system includes additional transient mitigation features such as Feed Only Good Generator and Automatic Flow Rate Control.

Completed: Refuel V
Cost: \$10,010,000

2. CDV-103,-104 Modifications

Description: Remove valve internals to prevent single failure from isolating EFW Pump Suction from water source (Condensate Storage Tank) disabling the EFW system.

Completed: Refuel V
Cost: \$15,000

3. ASV-204 (ASV-5 Bypass)

Description: Install redundant steam admission valve for EFPT-1. Assure single failure will not prevent operation of Steam Driven EFW Pump.

Completed: Refuel V

Cost: \$300,000

4. Seismic Qualification

Description: Perform analyses and install required piping and electrical supports. To assure EFW system will remain operational through and following a seismic event.

Completed: Refuel V

Cost: \$400,000

5. EFTB-1 Missile Evaluation

Description: Evaluation performed to assure missiles generated as a result of a catastrophic failure of the steam driven pump turbine would not damage equipment necessary for the EFW System to function with the motor driven pump. No modification was required.

Completed: August 1984

Cost: \$1000

6. Motor Operated Valves

Description: All AC operated EFW Valves have been locked open and determinated to prevent short circuit spurious valve operation during a seismic event. Valves were powered from non seismic, non safety related Motor Control Centers. Spurious operation could disable EFW system.

Ref: EFIC

7. Appendix "R" Upgrade

Description: Evaluate and upgrade EFW circuits to meet Appendix "R" criteria by rerouting or wrapping. Fully integrate EFIC with Appendix "R" upgrade.

Cost: \$2,000,000

8. Environmental Qualification of Equipment

Description: Identify and evaluate all EFW equipment located in a harsh environment. Provide detailed qualification records for existing equipment or replace the equipment to meet the EQ requirements. Full consideration of EQ requirements for EFIC design.

Cost: \$250,000

9. Technical Specification Revision

Description: A full flow test of the EFW system is performed following cold shutdowns.

D. ACTIVE PROJECTS

1. Dedicated EFW Tank

Description: Provide a tornado and flood protected EFW system water source. Current primary water source is not tornado or flood protected and does not have full safety grade instrumentation.

Schedule: Refuel VI Completion

Cost: \$2,900,000

2. Class I-E Level Instrumentation

Description: Provide safety grade level instrumentation for new tank.
Cost: Included in tank cost.

3 Reliability Analysis (PRA)

Description: Provide a model to evaluate system reliability

Schedule: November 1985 Completion

Cost: \$300,000

E. SUMMARY

Total approximate cost: \$16,176,000