Florida Power
CORPORATION

June 12, 1990
3F0690-03

Document Control Desk
U. S. Nuclear Regulatory Commission
Washington, DC 20555

Subject: Crystal River Unit 3
Docket No. 50-302
Operating License No. DPR-72
High Energy Line Break Program

Dear Sir:

The NRC issued an exemption to Florida Power Corporation (FPC) from the requirements of 10 CFR 50, Appendix A, General Design Criteria 4 (GDC-4) on June 5, 1989. The exemption is to expire at the end of Refuel 7. FPC is implementing improved high energy line break (HELB) criteria during this refueling outage to resolve the issues which necessitated the exemption. FPC will have completed actions related to the exemption by the end of the refueling outage. As part of this effort, FPC has performed zone temperature calculations for each of the postulated breaks. During our program for review of these calculations, it was determined that a 24" main steam line break in the Intermediate Building may not envelope all other breaks. The terminal end break of either of two 6" lines to the emergency feedwater pump turbine or a crack at any one of several locations on the 24" main steam lines upstream of the main steam isolation valves may create more harsh environmental conditions in the Intermediate Building. This is because the duration of these events causes high temperatures to be sustained for a longer period of time. This could result in equipment temperature profiles that exceed current environmental qualifications for the equipment affected. The most significant equipment impacted by this potential high temperature are the components associated with the main steam and feedwater isolation function of the Emergency Feedwater Initiation and Control System. A complete list of equipment which can not be qualified without taking credit for supplemental

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mitigation actions (insulation and sprinkler effects) will be provided by June 15, 1990.

FPC has taken the following actions to resolve this concern:

1. FPC has performed a detailed assessment of the area to check physical features included in the Intermediate Building heatup model, such as heat sinks and sources of cool air for natural circulation. These additional features were included in the model but did not fully mitigate the temperature profile concern.

2. Babcock & Wilcox (B&W) has been contracted to verify the mass/energy release used by Gilbert/Commonwealth to validate this input to the zone temperature model.

3. FPC is pursuing reanalysis using a second, more sophisticated model for the calculation. The first preliminary results indicate a significant reduction in the short term peak temperature. The high temperatures are still sustained for an unacceptably long period of time. These results cannot be finalized, however, until the work described in Item 2 above is completed.

4. Several types of equipment are being insulated to ensure short term temperature transients do not cause the equipment to exceed the acceptable temperatures. This equipment includes local control stations, motor starters, terminal blocks and transmitters. The insulation combined with thermal lag analysis will be utilized to demonstrate continued operability of the equipment.

In addition to the actions already taken to resolve this issue, FPC intends to rely on calculations which show that an acceptable environment can be assured by taking credit for the area's Appendix R fire suppression sprinklers. While the sprinkler systems are not fully safety grade, they are depended on to mitigate the effects of postulated fires potentially affecting the same equipment as the assumed high energy line break. Additionally, the fire protection system has many features to assure the high reliability needed for protection systems. Only four sprinklers in the area adjacent to the break need to actuate to reduce the temperature to acceptable levels. The area of one of the 6" line breaks is protected by 17 sprinklers and the other by 10. The areas of the postulated main steam line cracks are also protected by redundant sprinklers. These features are described in detail in the Attachment 1 to this letter.

FPC will continue to pursue analytical activities with the intent to fully qualify affected equipment without reliance on the Appendix R Sprinkler System. If plant modifications are required they will be tentatively scheduled for completion by the end of Refuel 8 but must be coordinated with material delivery and other NRC commitment priorities through our master schedule process. NRC approval will be sought for any schedule changes. Modifications could include a combination of altering the Intermediate Building's ventilation characteristics, relocation or replacement of equipment or others not yet identified. Such modifications require substantial planning, design and lead time for critical materials. These modifications will be further defined in the next several weeks. Once a plan and schedule are finalized we will supplement this interim corrective action plan by October 1, 1990. FPC will also provide quarterly updates on our progress until the issue is resolved. If you have any questions, please contact Mr. Rolf C. Widell, Director, Nuclear Site Support at (904) 563-4529. I appreciate the prompt review your staff has given this issue and look forward to bringing this to closure.

Sincerely,

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

PMB/AEF:

Attachments

xc: Regional Administrator, Region II
Senior Resident Inspector

ATTACHMENT 1

FIRE PROTECTION SYSTEM RELIABILITY FOR PROVIDING WATER TO THE INTERMEDIATE BUILDING FOLLOWING A HIGH ENERGY LINE BREAK

This document provides an assessment of the reliability of the fire protection system's components servicing the 119' elevation of the Crystal River 3 (CR-3) Intermediate Building. The operation of this system may be necessary to assure safety related components will not be subjected to temperatures which could cause failure.

The fire protection system servicing this area originates with two 360,000 gallon redundant, fire service water storage tanks. These tanks serve two redundant diesel driven fire service pumps, each with its own independent fuel supply. Each pump feeds separately into a common fire protection system supply header which then provides fire service water to the plant. In addition to the diesel driven pumps, a motor driven pump is normally aligned to one of the fire service water tanks and provides additional redundancy. Each pump is capable of delivering 2000 gpm at 125 psig.

Two of the postulated pipe breaks for which the fire protection system is being relied upon to provide a constant spray, are ruptures located at the junction of the 6" steam lines to the emergency feedwater pump turbine and the 24" main steam lines, upstream of valves MSV-55 and MSV-56. An additional failure is a 0.037 square foot crack at any of 21 postulated locations on the four main steam lines in the Intermediate Building upstream of the main steam isolation valves. The fire protection system is not required to operate for any other postulated HELB's in the Intermediate Building. The postulated breaks from the two 6" lines are currently limited in their spray pattern and pipe movement by jet shields and restraints. Spray from a crack in the 24" main steam lines has been limited by shields which have been installed where required. Therefore, the jet spray and pipe whip could not damage the fire protection system lines.

The line which feeds the fire protection system sprinkler heads located in the Intermediate Building 119' elevation is routed through the Turbine Building. The sprinkler lines in the Intermediate Building were installed to satisfy the requirements of 10 CFR 50, Appendix R. These lines were designed to the then current NFPA Code, Volumes 13 and 14. The fire protection system equipment, pipe, valves, and sprinkler heads are not safety-related. However, they were purchased through an augmented quality program. The quality program ensures that materials are either Underwriters Laboratory or Factory Mutual approved, or are manufactured by suppliers whose product reliability has been verified by other means. The portion of the piping system in the Intermediate Building is supported to Seismic Category I criteria for falldown to prevent interaction with nearby safety related equipment during a seismic event. The portion of the system outside the Intermediate Building is supported as required by the NFPA Code, Volumes 13 and 14.

The CR-3 HELB criteria document recently approved by the NRC, "Pipe Rupture Analysis Criteria Outside the Reactor Building - Crystal River Unit 3", Section 3.6.2.2, stipulates failure responses of components that need to be applied concurrent with a HELB. Random single failures of active components are postulated. However, passive failures, not resulting from the initial event, are not. The fire protection system, including the Intermediate Building sprinklers, satisfies that requirement. The active components which provide water to the Intermediate Building are the fire service pumps and the sprinkler heads. The diesel pumps are redundant and the third pump is also available if off-site power has not been lost.

Of the 39 total sprinkler heads in the Intermediate Building area, 17 are situated to spray in the area of MSV-55 and 10 are in the area of MSV-56. Sprinklers are available to mitigate cracks in the main steam lines as follows:

Main Steam Line	Number of Sprinklers
A-1	7
A-2	5
B-1	6
B-2	5

Only four sprinkler heads are required to actuate for the 6" line break, to reduce the temperature to an acceptable value. When the fusible link ruptures approximately 15 gpm per head will be provided if the supply pressure is 7 psig. Higher supply pressure will result in a higher flow.

The fusible links in these heads are rated at 212 °F, and the calculated peak bulk room temperature for these HELB's is in excess of 300 °F. This large margin between the setpoint and the actual temperature provides added assurance that the heads will quickly activate. The steam atmosphere following a HELB will not affect the fusible link temperature setpoint.

The fire protection system is operated and tested to written, approved procedures similar to those used for safety related activities (See Attachment 2). System operability and testing is required by CR-3 Technical Specification Section 3.7.11.1. FPC will administratively impose more restrictive remedial actions during the period of time when those systems are relied upon to perform this design basis accident mitigation function. The existing allowed outage times will be reduced to 72 hours. If the system is not returned to service within that period of time the unit will be placed in Mode 4 within 12 hours.

A probabilistic risk assessment has been performed for the 6" line break to estimate the probability the fire service sprinklers will not function as required. The probability the system will not function to reduce the temperature is approximately 8×10^{-3}. Combining this with the expected steam line rupture frequency, yields an overall frequency for

not mitigating this event of less than 10^{-7} per year. Since failure of the sprinkler system would still most likely not result in core damage, the frequency calculated would be even lower if that were the final condition. The calculated event frequency is still less than the threshold of NUREG-1335, "Individual Plant Examination: Submittal Guidance" for core damage sequences which should be reported in the IPE submittals to the NRC. These numbers demonstrate that the reliability of the fire protection system at CR-3 is consistent with the reliability of safety systems used to mitigate design basis accidents at nuclear power plants.

Based on this evaluation, it can be concluded the fire protection system inherently possesses a design which enhances its reliability. The system design will allow it to operate following any of the high energy line breaks in question. In summary, the system reliability is based upon the following factors:

1. The fire protection system water sources and pumps are redundant.

2. The sprinkler heads required to function are redundant.

3. There is no single active failure which can prevent the system from performing its function.

4. The amount of water required to reduce the temperature is small compared to the supply and the delivery capability.

5. Operability of the system is assured by Technical Specifications.

6. Materials are utilized in these systems' construction which assure a high reliability.

7. The system is tested and operated in a manner which assures high reliability.

ATTACHMENT 2

PROCEDURES FOR OPERATION AND TESTING OF THE FIRE SUPPRESSION SYSTEM

OPERATION

OP-880 Fire Service System

TESTING

Surveillance Requirement	Proced. No.	Title
4.7.11.1.a	SP-300	Operating Daily Surveillance Log
	SP-301	Shutdown Daily Surveillance Log
4.7.11.1.b	SP-365A	Electric Fire Service Pump, FSP-1 Operability
	SP-365B	Diesel Fire Service Pump, FSP-2A Operability
	SP-365C	Diesel Fire Service Pump, FSP-2B Operability
4.7.11.1.c	SP-367	Fire Service Valve Alignment and Operability Check
4.7.11.1.d	SP-367	Fire Service Valve Alignment and Operability Check
4.7.11.1.e.1	SP-411C	Fire Service Fixed Water Spray System - Auxiliary Building
	SP-411D	Fire Protection for Emergency Diesel Generators
	SP-411E	Fire Service Sprinkler and Fixed Water Spray Systems Control Complex
	SP-411F	Fire Service Fixed Water Spray Systems - Turbine Building
4.7.11.1.e.2	SP-363	Fire Protection System Tests
4.7.11.1.e.3	SP-366	Fire System Annual Valve Surveillance
4.7.11.1.e.4	SP-363	Fire Protection System Tests
4.7.11.1.f	SP-408	Fire System Flow Test
4.7.11.1.g.1.(a)	SP-365B	Diesel Fire Service Pump, FSP-2A Operability
	SP-365C	Diesel Fire Service Pump, FSP-2B Operability

Surveillance Requirement	Proced. No.	Title
4.7.11.1.g.1.(b)	SP-365B	Diesel Fire Service Pump, FSP-2A Operability
	SP-365C	Diesel Fire Service Pump, FSP-2B Operability
4.7.11.1.g.2	SP-365D	Fire Service Diesel Engine Fuel Sampling
4.7.11.1.g.3.(a)	SP-606	Diesel Fire Pump Engine Inspection and Maintenance
4.7.11.1.g.3.(b)	SP-363	Fire Protection System Tests
4.7.11.1.h.1.(a)	SP-502	Fire Pump Diesel Batteries Weekly Check
4.7.11.1.h.1.(b)	SP-502	Fire Pump Diesel Batteries Weekly Check
4.7.11.1.h.2	SP-503	Fire Pump Diesel Batteries Quarterly Check
4.7.11.1.h.3.(a)	SP-503	Fire Pump Diesel Batteries Quarterly Check
4.7.11.1.h.3.(b)	SP-503	Fire Pump Diesel Batteries Quarterly Check