

April 27, 2000

Mr. John Paul Cowan
Vice President, Nuclear Operations
Florida Power Corporation
ATTN: Manager, Nuclear Licensing (NA1B)
Crystal River Energy Complex
15760 W. Power Line Street
Crystal River, Florida 34428-6708

SUBJECT: REVIEW OF FLORIDA POWER CORPORATION'S RESPONSE TO GENERIC LETTER 96-06 CONCERNING WATERHAMMER, TWO-PHASE FLOW, AND EXPANSION OF ENTRAPPED WATER IN PIPING FOR CRYSTAL RIVER UNIT 3 (TAC NO. M96800)

Dear Mr. Cowan:

On September 30, 1996, the U.S. Nuclear Regulatory Commission (NRC) issued Generic Letter (GL) 96-06, "Assurance of Equipment Operability and Containment Integrity During Design-Basis Accident Conditions," to holders of operating licenses for nuclear power reactors, except those that have been amended for a possession-only status. The purpose of the GL was to: (1) notify addressees about safety-significant issues that could affect containment integrity and equipment operability during accident conditions, (2) request that all addressees submit certain information relative to the issues that have been identified and implement actions as appropriate to address these issues, and (3) require that all addressees submit a written response to the NRC relative to implementation of the requested actions. The following issues were identified as being of concern:

- (1) Cooling water systems serving the containment air coolers may be exposed to the hydrodynamic effects of waterhammer during either a loss-of-coolant accident (LOCA) or a main steamline break (MSLB). These cooling water systems were not designed to withstand the hydrodynamic effects of waterhammer and corrective actions may be needed to satisfy system design and operability requirements; and
- (2) Cooling water systems serving the containment air coolers may experience two-phase flow conditions during postulated LOCA and MSLB scenarios. The heat removal assumptions for design-basis accident scenarios were based on single-phase flow conditions. Corrective actions may be needed to satisfy system design and operability requirements.
- (3) Thermally induced overpressurization of isolated water-filled piping sections in containment could jeopardize the ability of accident-mitigating systems to perform their safety functions and could also lead to a breach of containment integrity via bypass leakage. Corrective actions may be needed to satisfy system operability requirements.

Licenses were requested to determine: (1) if containment air cooler cooling water systems are susceptible to either waterhammer or two-phase flow conditions during postulated accident conditions; and (2) if piping systems that penetrate the containment are susceptible to thermal expansion of fluid so that overpressurization of piping could occur. The GL requested the licenses provide (A) a 30-day response identifying (1) whether or not the requested actions will be completed, (2) whether or not the requested information will be submitted and (3) whether or not the requested information will be submitted within the requested time period and, (B) a 120-day response providing a written summary report stating (1) actions taken in response to the requested actions noted above, (2) conclusions that were reached relative to susceptibility for waterhammer and two-phase flow in the containment air cooler cooling water system and overpressurization of piping that penetrates containment, (3) the basis for continued operability of affected systems and components as applicable, (4) corrective actions that were implemented or are planned to be implemented, and (5) if systems were found to be susceptible to the conditions that are discussed in this GL, the systems affected and specific circumstances involved.

Florida Power Corporation (FPC) provided its assessment of the waterhammer and two-phase flow issues for Crystal River Unit 3 (CR-3) in a letter dated January 27, 1997, and additional information was submitted by letters dated June 30, and December 14, 1998. Based on the staff's review of the information that was provided, it is our understanding that: (a) the service water (SW) system surge tank maintains sufficient system overpressure to prevent steam from forming during the event scenarios of interest, and (b) waterhammer or two-phase flow conditions will not occur during the postulated worst-case conditions (including single failure assumptions). Plant operators are alerted to abnormal conditions in the SW surge tank by control room annunciation. We are satisfied with your response and consider the waterhammer and two-phase flow elements of GL 96-06 to be closed for CR-3.

FPC's January 27 and October 17, 1997, submittals provide the response to the issue of thermally-induced pressurization of piping runs penetrating the containment for CR-3. In the January 27, 1997, submittal, 33 penetrations were identified as potentially vulnerable to a water solid volume subject to an increase in pressure due to heating of trapped fluid. With regard to operability assessment of the affected penetrations, it was stated that CR-3 was in cold shutdown and no actions were immediately necessary to assure continued operability of affected systems. FPC proposed to resolve the overpressurization concerns by completing necessary plant modifications prior to start-up from the outage that CR-3 was in at that time. The staff found that proposal acceptable.

In the October 17, 1997, submittal, a summary was provided of the evaluation of GL 96-06 issues for CR-3 and the actions necessary to resolve the overpressurization of vulnerable penetrations. In this letter, a total number of 37 penetrations were identified for evaluation (four more than those identified in the January 27, 1997 letter). It was indicated that: (1) 11 penetrations were modified by installation of expansion chambers with rupture discs to allow for expansion of trapped fluid, (2) 2 penetrations were modified and fitted with rupture discs without expansion chambers inside containment, and (3) the remaining 24 penetrations had existing relief valves, but some of them were found inadequate and would be replaced.

In a more recent letter dated June 21, 1999, it was stated that an additional plant modification would be made to install relief valves in place of existing expansion chamber/rupture disc or rupture disc configuration for certain penetrations. The change is needed because improper sizing of rupture discs has resulted in premature failures of several rupture discs. It was stated that the new relief valves will be sized to provide adequate protection for overpressurization of these penetrations.

Because installation of relief valves, or rupture discs with or without expansion chambers are acceptable means for relieving pressure of a solid water volume, the staff finds that the corrective actions, i.e., installation of relief valves or rupture discs, provide an acceptable resolution for the issue of thermally-induced pressurization of piping runs penetrating the containment, and the closed piping segments inside the containment.

As discussed above, all requested information has been provided. The staff has reviewed the information and concluded that GL 96-06 requirements are met. Therefore, we consider GL-96-06 closed for Crystal River Unit 3. If you have any questions concerning this matter, please contact me at (301) 415-1495.

Sincerely,

/RA/

Leonard A. Wiens, Senior Project Manager, Section 2
Project Directorate II
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket No. 50-302

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Project Directorate II
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Mr. John Paul Cowan
Florida Power Corporation

CRYSTAL RIVER UNIT NO. 3

cc:

Mr. R. Alexander Glenn
Corporate Counsel (MAC-BT15A)
Florida Power Corporation
P.O. Box 14042
St. Petersburg, Florida 33733-4042

Chairman
Board of County Commissioners
Citrus County
110 North Apopka Avenue
Inverness, Florida 34450-4245

Mr. Daniel L. Roderick, Director
Nuclear Plant Operations (NA2C)
Florida Power Corporation
Crystal River Energy Complex
15760 W. Power Line Street
Crystal River, Florida 34428-6708

Ms. Sherry L. Bernhoft, Director
Nuclear Regulatory Affairs (NA2H)
Florida Power Corporation
Crystal River Energy Complex
15760 W. Power Line Street
Crystal River, Florida 34428-6708

Mr. Michael A. Schoppman
Framatome Technologies Inc.
1700 Rockville Pike, Suite 525
Rockville, Maryland 20852

Senior Resident Inspector
Crystal River Unit 3
U.S. Nuclear Regulatory Commission
6745 N. Tallahassee Road
Crystal River, Florida 34428

Mr. William A. Passetti, Chief
Department of Health
Bureau of Radiation Control
2020 Capital Circle, SE, Bin #C21
Tallahassee, Florida 32399-1741

Mr. Gregory H. Halnon
Director, Quality Programs (SA2C)
Florida Power Corporation
Crystal River Energy Complex
15760 W. Power Line Street
Crystal River, Florida 34428-6708

Attorney General
Department of Legal Affairs
The Capitol
Tallahassee, Florida 32304

Mr. Joe Myers, Director
Division of Emergency Preparedness
Department of Community Affairs
2740 Centerview Drive
Tallahassee, Florida 32399-2100