Florida
Power
CORPORATION
Crystal River Unit 3
Docket No. 50-302

April 7, 1997
3F0497-09

U. S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, D. C. 20555-0001

Subject: Licensee Event Report (LER) 97-008-00

Dear Sir:

Please find the enclosed Licensee Event Report 97-008-00 concerning an unanalyzed condition involving the potential of High Pressure Injection (HPI) pump recirculation capability resulting in possible Makeup Tank overflow or possible pump failure.

This report is submitted by Florida Power Corporation in accordance with 10 CFR 50.73.

Sincerely,

J. J. Holden, Director
Nuclear Engineering and Projects

JJH/TWC

Attachment

xc: Regional Administrator, Region II
Project Manager, NRR
Senior Resident Inspector

IE22 1/1

NRC FORM 366 (5-92)

U.S. NUCLEAR REGULATORY COMMISSION

APPROVED OMB NO. 3150-0104

EXPIRES 5/31/95

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 50.0 HOURS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE RECORDS AND REPORTS MANAGEMENT BRANCH (MNBB 7714), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555-0001, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0104), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON DC 20503.

LICENSEE EVENT REPORT (LER)

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
CRYSTAL RIVER UNIT 3 (CR-3)	0 5 0 0 0 3 0 2	1 OF 0 7

TITLE (4)

Discovery of Original Design Configuration Resulting in Unanalyzed Condition Regarding High Pressure Injection Pump Recirculation Leading to Possible Pump Failure and Dose Consequences

EVENT DATE (5)			LER NUMBER (6)			REPORT DATE (7)			OTHER FACILITIES INVOLVED (8)	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	MONTH	DAY	YEAR	FACILITY NAMES	DOCKET NUMBER(S)
									N/A	0 5 0 0 0
0 3	0 7	9 7	9 7	--- 0 0 8	--- 0 0	0 4	0 7	9 7	N/A	0 5 0 0 0

OPERATING MODE (9)	5	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (CHECK ONE OR MORE OF THE FOLLOWING) (11)			
POWER LEVEL (10)	0 0 0	20.402(b)	20.405(c)	50.73(a)(2)(iv)	73.71(b)
		20.405(a)(1)(i)	50.36(c)(1)	50.73(a)(2)(v)	73.71(c)
		20.405(a)(1)(ii)	50.36(c)(2)	50.73(a)(2)(vii)	OTHER (Specify in Abstract below and in Text, NRC Form 366A)
		20.405(a)(1)(iii)	50.73(a)(2)(i)	50.73(a)(2)(viii)(A)	
		20.405(a)(1)(iv)	X 50.73(a)(2)(ii)	50.73(a)(2)(viii)(B)	
		20.405(a)(1)(v)	50.73(a)(2)(iii)	50.73(a)(2)(x)	

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER
T. W. Catchpole, Sr. Nuclear Licensing Engineer	AREA CODE 3 5 2 5 6 3 - 4 6 0 1

COMPLETE ONE LINE FOR EACH COMPONENT FAILURE IN THIS REPORT (13)

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS		CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS	

SUPPLEMENTAL REPORT EXPECTED (14)		EXPECTED SUBMISSION DATE (15)	MONTH	DAY	YEAR
YES (If yes, complete EXPECTED SUBMISSION DATE)	X NO				

ABSTRACT (Limit to 1400 spaces, i.e., approximately fifteen single-space typewritten lines (16)

On March 7, 1997, Crystal River Unit 3 (CR-3) was in COLD SHUTDOWN. A review was completed which determined that a condition previously identified in October, 1996 as a restart issue had not been adequately reviewed and evaluated for reportability. This resulted in the discovery that the plant had been in an unanalyzed condition during a Small Break Loss of Coolant Accident (SBLOCA) that could result in transfer of contaminated water from the Reactor Building sump to the Auxiliary Building via the Makeup Tank resulting in dose rate increases. In addition, another scenario could result in a failure to establish High Pressure Injection (HPI) pump recirculation which could lead to HPI pump failure. This condition was reported as a 4-hour report at 1748 hours in accordance with 10 CFR 50.72(b)(2)(i).

The scenario of concern occurs during certain SBLOCAs after regaining subcooling margin (SCM). The cause of the event was design error in that CR-3's original design did not adequately consider the full range of break sizes and did not address a very small break LOCA that would result in a requirement to throttle HPI to the point where minimum flow recirculation is required. CR-3 will remain shut down until this and other design margin deficiencies are resolved. A plant modification will ensure recirculation capability to the makeup pumps will be provided to assure adequate pump protection and prevent overflow of the makeup tank.

EVENT DESCRIPTION

On March 7, 1997, Crystal River Unit 3 (CR-3) was in MODE 5 (COLD SHUTDOWN). A review was completed which determined that a condition previously identified in October, 1996 as a restart issue had not been adequately reviewed and evaluated for reportability. This resulted in the discovery that the plant had been in an unanalyzed condition due to previously unevaluated accident scenarios involving High Pressure Injection (HPI) pump [BP,P] recirculation. At 1530 hours on March 7, 1997 the Nuclear Shift Manager (NSM) was informed of the condition and subsequently made a 4-hour report at 1748 hours in accordance with 10 CFR 50.72(b)(2)(i) which was assigned Event Number 31914.

The scenario of concern occurs during certain Small Break Loss of Coolant Accidents (SBLOCAs) after regaining subcooling margin. During SBLOCA scenarios, operators are instructed by Emergency Operating Procedures (EOPs) to throttle HPI flow after regaining subcooling margin (SCM), in order to maintain minimum SCM for Pressurized Thermal Shock (PTS) considerations. If throttling HPI per this requirement resulted in HPI flow less than 200 gallons per minute (gpm), then EOP guidance requires opening the HPI pump recirculation line to the Makeup Tank [CB,TK](MUT). Recirculation flow would be introduced to the MUT at a rate of approximately 100 gpm per pump. If the HPI pumps are in "piggy back" alignment (described in System Description section) from the Low Pressure Injection [BQ,P](LPI) pumps, the HPI suction pressure will prevent the MUT suction line check valve [CB,V](MUV-65) from opening, thus preventing water from leaving the MUT and causing it to go solid. The fluid in the tank will eventually exceed tank capacity and overflow to the Auxiliary Building [NF] sump, thus contaminating portions of the auxiliary building, in essence transferring radioactivity from Reactor Coolant System [AB](RCS) leakage from the Reactor Building [NH](RB) sump. An Auxiliary Building flooding analysis/evaluation cannot be located for this alignment. A dose assessment also does not exist to assure the function of the Control Room Emergency Ventilation System [VI](CREVS) and to evaluate offsite doses for this alignment. In addition, an analysis is not available to address the depletion of inventory from the RB sump resulting from overflow of MUT capacity.

Another postulated event has been determined be a failure of either of the two makeup pump recirculation valves (MUV-53 and MUV-257) whose power supplies are not single failure proof and which are installed in series with both required to be open to establish a recirculation path. A failure of the recirculation valve and inability to establish recirculation flow may result in HPI pump damage if HPI is throttled to very low flow rates after SCM is restored. Single failure criteria requires redundancy within systems to ensure the capability of meeting their design function.

Failure to address the plant conditions based on the postulated scenario describe in this event resulted in the plant being in an unanalyzed condition and, as such, is reportable pursuant to 10 CFR 50.73(a)(2)(ii).

SEQUENCE OF REPORTABILITY DETERMINATION ACTIONS

This scenario was initially identified as a concern during a focussed review of Emergency Operating Procedures (EOPs) in January, 1996. A Precursor Card was generated on January 8, 1996 on the basis of a previous Request for Engineering Assistance (REA) evaluated in 1994 as a plant enhancement which addressed MUT integrity during MUP recirculation alignments. The January 1996 precursor described the same scenario as discussed in this event and was tracked by the EOP Enhancement Group, but based on discussions with plant operations management, was not considered a credible design issue due to the small size of the postulated RCS break and the length of time it would take for depletion of the BWST. It was determined the issue could be resolved by procedural guidance to the operators. After a forced outage that occurred on September 2, 1996, FPC management directed a critical reexamination of certain design related issues that were considered to affect design margins for significant safety systems. A decision was made to keep the plant shut down until these issues are adequately addressed. FPC notified the NRC of its decision to keep the plant shut down by FPC Letter 3F1096-22 dated October 28, 1996. This letter included a description of planned modifications to address this and other design margin issues.

The FPC Restart Issue which describes this condition (D-1) references Problem Report 96-0440 which was evaluated by the NSM on October 30, 1996 as not reportable, but subject to further evaluation. On November 18, 1996, when presented with the root cause and corrective action plan for the Problem Report, the NSM determined the root cause determination may have uncovered a new issue not bounded by the Problem Report. A new Precursor Card was generated on January 6, 1997 to address the NSM's concerns. The new precursor was graded as a significant issue warranting a formal root cause but was apparently misplaced and not communicated to the design engineering organization although the issue continued to be investigated as a restart issue. This error was not detected until members of the D-1 Restart Issue team questioned the status of reportability and generated a memo indicating the condition described in the January 1997 precursor was a Design Basis Issue. The issue was then presented on March 7, 1997, to the NSM who made the 4-hour report as noted above.

SYSTEM DESCRIPTIONS

During normal reactor operation, the MU system recirculates reactor coolant for purification and soluble poison control, provides makeup water for normal RCS leakage, and provides RCP seal injection. The HPI function of the MU system provides emergency core cooling during SBLOCA's. HPI actuates when RCS pressure decreases below 1500 pounds per square inch gauge (psig) or when containment [NH] pressure reaches 4 psig. When HPI actuates, two HPI pumps start with suction aligned to the Borated Water Storage Tank [BP,TK] (BWST) and discharges into the RCS cold leg piping between the RCP's and the reactor vessel [RPV]. Certain SBLOCA's result in the RCS repressurizing to the point where throttling HPI flow becomes necessary to prevent Pressurized Thermal Shock (PTS). Control valves [BQ,FCV] in each of the four HPI lines are used to provide throttling and isolation in accordance with EOP guidance.

The MU system and HPI flowpath is depicted in Figure 1. The "piggy back" alignment occurs during certain Small Break Loss of Coolant Accidents (SBLOCA) after water in the Borated Water Storage Tank [BP,TK](BWST) is depleted and when RCS pressure is still too high for low pressure injection. In this condition, LPI pumps are aligned to the suction of the HPI pumps to ensure adequate net positive suction head (NPSH) to the HPI pumps.

The LPI system is an integral part of the Decay Heat Removal System (DH).

CAUSE OF EVENT

CR-3's original design did not adequately consider the full range of break sizes and did not address a very small break LOCA that would result in a requirement to throttle HPI to the point where minimum flow recirculation is required. When the failure scenario described in this event report was first identified in 1994 it was decided that the issue could be resolved by a change to EOPs. This nonconservative decision was an example of insufficient regulatory sensitivity which led to the failure to recognize the significance of the issue as an unanalyzed condition. CR-3's Phase II Management Corrective Action Plan (MCAP II) recognizes the lack of regulatory sensitivity as a root cause.

ANALYSIS OF EVENT

The primary safety considerations for events are the capability to conduct a safe plant shutdown and maintain the plant in a safe condition. The potential loss of this capability could be postulated if this SBLOCA event were to have actually occurred. The probability of all SBLOCAs at CR-3 is estimated to be 2.5E-3 per year; however, the SBLOCA described in this event would be a subset of that probability which reduces the potential significance of this condition. While it is technically possible to have a SBLOCA small enough to result in HPI throttling below 200 gpm, the adverse consequences could take a considerable amount of time to occur, allowing sufficient time to develop accident mitigation strategies.

A SBLOCA involves a relatively slow system depressurization. HPI is initiated on low RCS pressure or high Reactor Building pressure. Bypass flow to the MUT is secured when MUV-53 and MUV-257 close on an Engineered Safeguards (ES) isolation signal. As RCS pressure is reduced, the leak rate decreases and allows subcooling margin to be recovered with HPI. Once subcooling margin is regained, HPI flow is throttled to control RCS pressure.

Eventually, while minimizing subcooling margin, by throttling HPI flow, operators could reduce the flow rate below the pump's minimum flow requirement. To provide minimum pump flow, a flow path is established by opening MUV-53 and MUV-257. If one of these valves fails to open, a recirculation path can not be established and the Makeup/HPI pumps may fail due to extended operation under low-flow conditions. However, recent information obtained from the pump manufacturer, Sulzer Bingham Pumps, Inc., states that a minimum flow of 40 gpm for a period of approximately 90 days during/after an accident condition, should not adversely affect the pump performance with adequate NPSH available.

If MUV-53 or MUV-257 were open while the LPI and HPI pumps are in the "piggyback" mode, the depletion of RB sump inventory through the MUT relief valve for long term operation in this alignment may have an adverse impact on NPSH available for the Building Spray Pumps [BE,P](BSP) if they were operating. At the low flow conditions in this event, the NPSH required for the LPI and HPI pumps is relatively low; however, this depletion could challenge the ability to provide pump protection. If RCS pressure is reduced to the LPI cut-in for decay heat removal (approximately 180 psig), the depletion of RB sump inventory could also affect the NPSH available to the LPI pumps.

There are several dose and flooding consequences from the unanalyzed overflow of water transferred from the RB sump to the Auxiliary Building sump through the MUT. One is that the increased radiation dose and flooding could affect the environmental qualification of equipment required to function during the accident. Another is that the increased dose in the Auxiliary Building could inhibit operator recovery actions after the accident. Finally, the increased radiation dose would exceed the currently projected offsite release doses through unfiltered pathways. However, these projected doses are significantly lower than 10 CFR 100 limits. Therefore, although not analyzed, the proportional increase would most likely not exceed the limits of 10 CFR 100.

IMMEDIATE ACTIONS

With the plant in MODE 5 this issue presents no operability or safety concern as HPI is not required to mitigate LOCAs in this mode.

CORRECTIVE ACTIONS

FPC made a decision to keep the plant shut down until this and other issues are adequately addressed. FPC has developed the Management Corrective Action Plan Phase II (MCAP II) to communicate management expectations and provide direction in several areas of plant performance. For reference purposes, the following corrective actions are identified as applicable with MCAP II Action Item designations. In addition, FPC formed a Restart Panel patterned after the NRC Inspection Manual Chapter 0350 "Staff Guidelines for Restart Approval" process to manage actions necessary to safely return CR-3 to power operation and ensure subsequent reliable operation. The following additional corrective actions are identified as applicable, with Restart Issue numbers. The restart issues include design and system readiness reviews to determine the extent of condition described in this report.

The following corrective actions have been or will be taken as a result of this event:

1. A "stand down" was implemented in Nuclear Operations Engineering (NOE) to emphasize the importance of improving safety culture. (MCAP Action B-RC1-1)

2. Engineering staffing levels have been increased to attract talent from outside FPC that can increase design competency. (MCAP Action B-RC1-7)

3. Training has been provided to managers and supervisors on the elements of achieving and maintaining regulatory compliance and its priority in plant activities. (MCAP Action D-RC1-2)

4. Additional recirculation capability for the HPI pumps will be provided by a plant modification to assure adequate pump protection and prevent the MUT relief valve from lifting. (FPC Restart Issue D-1)

ADDITIONAL INFORMATION

This is the first LER written to describe an unanalyzed condition with recirculation of the HPI pumps. There have been several LERs issued since 1989 with single failure vulnerability affecting the HPI system during SBLOCAs. These are described in LERs 89-037-00, 96-006-01, 96-007-01, and 97-005-00.

Figure 1 is attached for assistance in understanding CR-3's HPI and HPI pump recirculation flow paths.

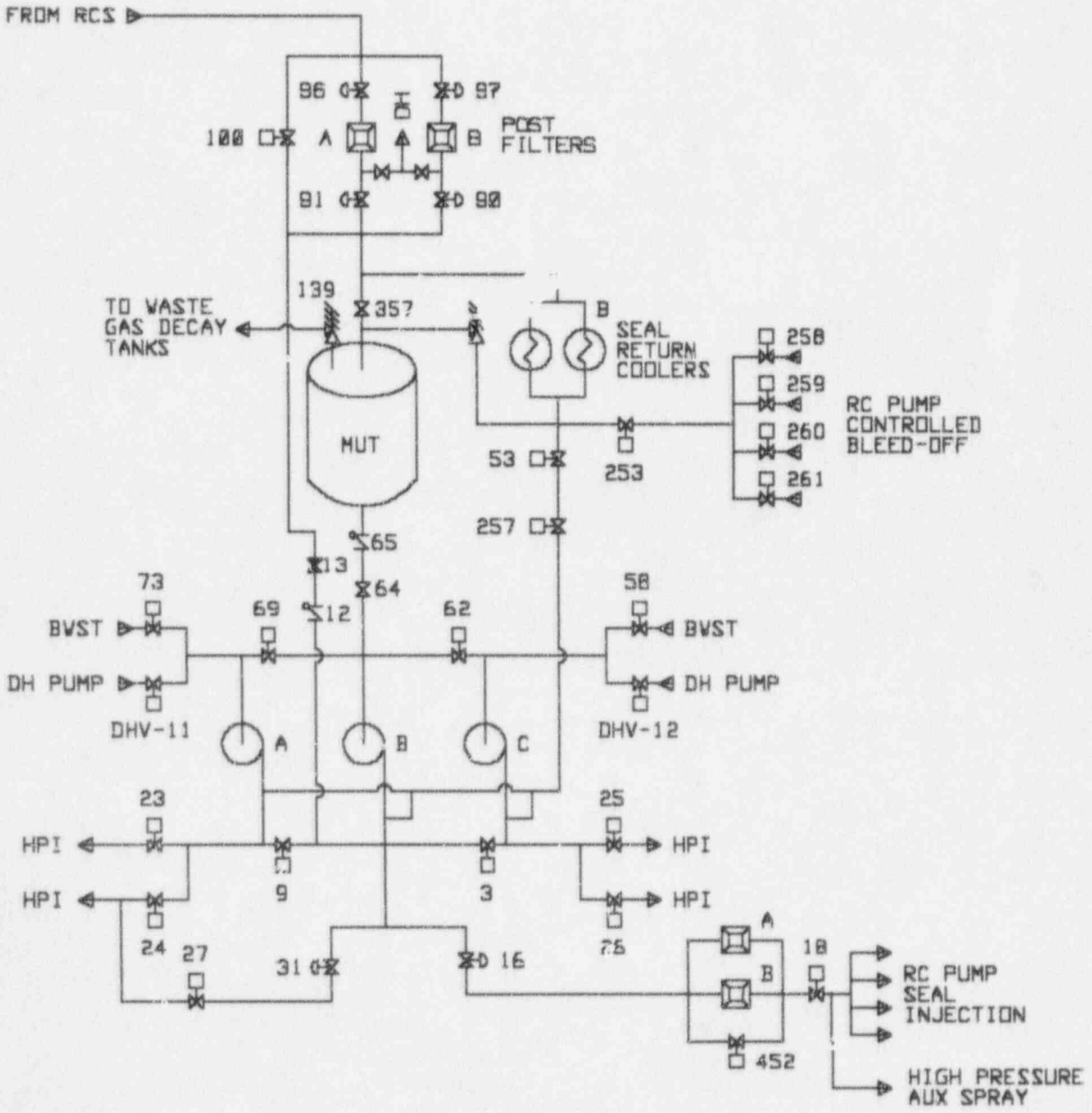

Figure 2 HPI and HPI Pump Recirculation Flow Path