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

February 29, 1996
3F0296-27

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

Subject: Licensee Event Report (LER) 96-006-00

Dear Sir:

Please find the enclosed Licensee Event Report (LER) 96-006-00. This report is submitted by Florida Power Corporation in accordance with 10 CFR 50.73.

Sincerely,

Ron Davis FOR BJ Hickle

B. J. Hickle, Director
Nuclear Plant Operations

TWC:ff

Attachment

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

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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 8

TITLE (4)

Consideration of Instrument Error Results in Unacceptable Margin for HPI Flow in SBLOCA Analysis

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 1	3 0	9 6	9 6	--- 0 0 6	--- 0 0	0 2	2 9	9 6	N/A	0 5 0 0 0

OPERATING MODE (9)	1	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (CHECK ONE OR MORE OF THE FOLLOWING) (11)			
POWER LEVEL (10)	1 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)	X 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)	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
	AREA CODE
T.W. Catchpole, Sr. Nuclear Licensing Engineer	3 5 2 5 6 3 - 4 6 0 1

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

CAUSE	SYSTEM	COMPONENT	MANUFAC-TURER	REPORTABLE TO NPRDS		CAUSE	SYSTEM	COMPONENT	MANUFAC-TURER	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 January 30, 1996, Florida Power Corporation's (FPC) Crystal River Unit 3 (CR-3) was in MODE 1 (POWER OPERATION), operating at 100% reactor power and generating 875 megawatts (MW). During a review of setpoints used in Emergency Operating Procedures (EOP), engineering personnel determined that unacceptable analytical results are obtained when worst case instrument error and EOP setpoints for preventing High Pressure Injection (HPI) pump runout are used in the Small Break Loss of Coolant Accident (SBLOCA) analysis. The SBLOCA analysis uses a core thermal power level of 2568 (MW). When the actual CR-3 licensed power level of 2544 MW is used, a proportionally lower minimum HPI flow requirement is obtained. This lower required minimum flow is within the error band for the flow instruments. The cause of the event was inadequate incorporation of design assumptions and appropriate flow instrument error in an EOP. Reactor Coolant Pump seal injection flow will be administratively isolated as an interim measure when full HPI is required, thereby assuring sufficient HPI flow to the reactor core. Other corrective actions include performing a new SBLOCA analysis to provide additional flow margin.

EVENT DESCRIPTION

On January 30, 1996, Florida Power Corporation's Crystal River Unit 3 (CR-3) was in MODE 1 (POWER OPERATION), operating at 100% reactor power and generating 876 megawatts (MW). During a review of Emergency Operating Procedure (EOP) setpoints, engineering personnel determined that application of worst case instrument error to the High Pressure Injection [BQ] (HPI) instrumentation may result in establishing inadequate HPI flow to the reactor core when complying with EOP guidance for preventing HPI pump [BQ,P] runout. The review of EOP related setpoints is part of an overall EOP Enhancement Program designed to ensure EOP steps have a well-defined technical basis.

EOP guidance requires HPI flow to be maintained less than 540 gallons per minute (gpm) per running HPI pump to prevent pump runout. Total instrument error associated with the HPI flow instrumentation could be 36 gpm less than indicated and 30 gpm greater than indicated, such that, with a flow indication of 540 gpm, actual flow could be 570 gpm or 504 gpm. The design basis for HPI pump runout is 575 gpm, which will not be obtained given the existing EOP guidance. The 504 gpm flow rate is less than the 509 gpm specified in the Small Break Loss-of-Coolant Accident (SBLOCA) analysis for Reactor Coolant System [AB] (RCS) pressure less than 200 pounds per square inch absolute (psia). After further investigation, it was determined that the SBLOCA analysis used a RATED THERMAL POWER (RTP) of 2568 MW thermal. Since design RTP for CR-3 is 2544 MW thermal, the lower RTP level requires proportionally less HPI flow to satisfy the SBLOCA analysis. In order to assure 504 gpm is delivered to the core, Reactor Coolant Pump [AB,P] (RCP) seal injection must be isolated early in the SBLOCA event. HPI flow cannot be increased without challenging the design basis HPI pump runout limit of 575 gpm. Due to a previous problem related to seal injection instrument error and qualification, RCP seal injection is required to be closed when establishing full HPI. Prior to the existence of this guidance, RCP seal injection was not isolated while mitigating LOCA's.

This report is being submitted in accordance with 10CFR50.73(a)(2)(v)(D) as a condition that alone could have prevented mitigating the consequences of an accident, in that when RCP seal injection was not previously isolated during the assumed SBLOCA, the analytical results were unacceptable.

EVENT EVALUATION

During normal reactor operation, the Makeup and Purification System [CB] (MU) recirculates reactor coolant for purification and soluble poison management, provides makeup water for normal Reactor Coolant System [AB](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]. Control valves [BQ,FCV] in each of the four HPI lines are used to provide balancing, throttling and isolation in accordance with EOP guidance.

Certain SBLOCA's result in depressurizing the RCS to the point where throttling HPI flow becomes necessary to prevent HPI pump runout from occurring. Per the existing Cold Leg Pump Discharge LOCA (CLPD SBLOCA) analysis, 509 gpm of HPI flow is required to be directed to the four HPI nozzles within 10 minutes after Engineered Safeguards (ES) actuation. As noted above, a required HPI flow rate of 504 gpm has been justified based on a proportional decrease in RTP.

Guidance, via Short Term Instruction (STI) was established on November 10, 1995 to isolate RCP seal injection when full HPI is required. This was an immediate corrective action to preclude using an unqualified instrument to prevent HPI pump runout. The effect of seal injection isolation was evaluated by the system engineer who noted the vendor (BW/IP International) instruction manual states the pump and seal cartridge are designed to operate continuously without seal injection flow as long as normal cooling water flow is maintained. In addition, isolating seal injection flow also isolates High Pressure Auxiliary Spray. This line provides an alternate method used to cool down the Pressurizer [AB,PZR] during normal cooldown operations and is not required to mitigate any accidents. With the application of the STI, EOP guidance to throttle HPI flow would now only use the HPI flow instrumentation to determine total HPI pump flow. This also provided assurance that the EOP guidance for throttling HPI to a value of 540 gpm would remain within the instrument error analysis. Licensee Event Report (LER) 95-026-00 was submitted to address this situation.

The STI from November 10, 1995 was still in effect when it was discovered throttling HPI to prevent HPI pump runout could also challenge the limiting SBLOCA analysis by applying instrument error on the low end. Therefore, operators would isolate RCP seal injection when full HPI was required, thus assuring all HPI flow would be injected into the RCS at the RCS cold legs. By applying the actual CR-3 licensed RTP level to the SBLOCA analysis and taking credit for the early isolation of RCP seal injection, the minimum flow requirement of 504 gpm can be met.

An operability assessment was initiated on February 6, 1996 in accordance with Compliance Procedure CP-150, "Identifying and Processing Operability Concerns." This procedure provides a structured approach toward determining the operability of plant components required for accident mitigation and safe shutdown of the plant and provides guidelines to ensure no loss of plant system or component safety function. The operability assessment was determined necessary because of concerns identified regarding the ability to close the seal injection flow path within the assumed 10 minutes of the accident.

Refer to Figure 1. Seal injection can be isolated by closing MUV-18 [BQ,V] or MUV-16 [BQ,FCV]. MUV-18 is powered from ES Motor Control Center [MCC] ES MCC 3AB and MUV-16 is an air operated flow control valve supplied by the Instrument Air System [LD] (IA). In the event of a SBLOCA concurrent with a Loss of Offsite Power (LOOP) and failure of one Emergency Diesel Generator [EK,DG] (EDG), MUV-18 could only be closed if powered from the operable diesel generator. If not powered from the operable EDG, ES MCC 3AB would need to be transferred to the operable ES 4160 Volt bus by depressing the manual transfer on the Main Control Board [MCBD] (MCB) electrical panel. MUV-16 could also be closed provided instrument air is available. During a total LOOP, instrument air would slowly diminish.

The frequency of a SBLOCA concurrent with a LOOP and a failure of one diesel generator, is 1.4E-08 per year; therefore, the problem of potentially having to switch power sources to ES MCC 3AB to effect closure of MUV-18 in this situation is relatively low.

Regarding MUV-16, although the IA system is non-safety related and not diesel backed, pressure in the instrument air header should be available when isolation of RCP seal injection is required. Engineering personnel reached this conclusion by considering that normal air pressure in the instrument air system is 120 psig, and since MUV-16 will operate satisfactorily down to 45 psig, the valve will continue to operate even with a significant loss in header pressure. Also considered was the fact that the IA system is indirectly tested on a quarterly basis. During this quarterly test, any rapid reduction of IA header pressure would be noted by operator/technicians and appropriate actions would be taken to restore system integrity.

CAUSE

The primary cause of this event was inadequate incorporation of design assumptions and appropriate flow instrument error in the EOP program. The EOP Enhancement Program was established because of recognized weaknesses in EOP setpoints. Instrument error has not been consistently applied to EOP setpoint values resulting in various discrepancies. The EOP Enhancement Team discovered the conditions associated with this event while reviewing the results of a revised calculation for Makeup/HPI Flow Loop Accuracy which was issued December 7, 1996. The revised calculation included a modified methodology for determining instrument errors.

IMMEDIATE CORRECTIVE ACTION

Framatome Technologies, Inc. was requested to evaluate the effect of instrument error on the SBLOCA analysis. Their evaluation supported a proportionally

reduced flow requirement based on the ratio of differences between the RTP assumed in the accident analysis and CR-3's licensed RTP.

Short Term Instruction 95-0061 was issued on November 10, 1995 to isolate RCP seal injection when full HPI is required and had an expiration date of February 6, 1996. STI 96-0008 was issued on February 6, 1996 to replace STI 95-0061 to ensure seal injection remains isolated when full HPI is required, pending a CLPD SBLOCA reanalysis to possibly justify lower HPI flows during the CLPD SBLOCA. The STI assures the HPI pump will not be in a runout condition following isolation of seal injection. With seal injection isolated, the EOP setpoint of 540 gpm can remain in the procedure thereby assuring adequate core cooling for the CLPD SBLOCA (504 gpm).

ADDITIONAL CORRECTIVE ACTION

Note: Items 1 through 3, below, are scheduled for completion prior to April 1, 1996. Item 4 has a scheduled completion date of September 17, 1996.

1. Determine if HPI pump runout conditions can be achieved with the existing CR-3 Emergency Core Cooling System (ECCS) configurations. This will be accomplished by re-running the computer model in the MU System Hydraulic Analysis for zero RCS pressure.

2. A revised CLPD SBLOCA analysis is currently being performed by Framatome Technologies (formerly B&W Nuclear Technologies) to justify a lower required HPI flow rate at reduced RCS pressures to provide additional flow margin in the MU system.

3. Based on results of items 1 and 2, the need for revision of EOP's will be determined if it is necessary to direct operators to isolate RCP seal injection.

4. If RCP seal injection must be isolated, then plant modifications will be evaluated to determine if automatic RCP seal injection isolation is appropriate to reduce operator burden.

ACTION TO PREVENT RECURRENCE

The EOP Enhancement Program will continue its ongoing effort of actively validating setpoints and steps contained in the EOP's by providing sound engineering bases. In addition, an Analysis/Calculation group is dedicated to the evaluation of instrument string errors. These two efforts will continue to be coordinated.

PREVIOUS SIMILAR EVENTS

There have been two similar events involving HPI Pumps and flow instrumentation. LER 89-37 reported instrumentation accuracy inadequacies to perform flow balancing during an HPI Line Break. LER 95-26 reported use of non-Regulatory Guide 1.97 instrumentation for measuring RCP Seal Injection flow.

ATTACHMENTS

Attachment 1 - Abbreviations, Definitions and Acronyms
Figure 1 - Makeup & Purification/HPI System (simplified)

ATTACHMENT 1 - ABBREVIATIONS, DEFINITIONS AND ACRONYMS

CR-3	Crystal River Unit 3
ECCS	Emergency Core Cooling Systems
EOP	Emergency Operating Procedure
FPC	Florida Power Corporation
HPI	High Pressure Injection
LOOP	Loss of Offsite Power
MODE ONE	POWER OPERATION (Greater Than 5 Percent Rated Thermal Power)
MCC	Motor Control Center
MU	Makeup and Purification System
Runout	Operation of a pump beyond its design capacity; indicated by a decrease in discharge head and excessive power consumption.
SBLOCA	Small Break Loss-of-Coolant Accident
STI	Short-Term Instructions are part of the Shift Order program which provides a means for operations management to communicate short-term information and administrative instructions to shift personnel.

NOTES: ITS defined terms appear capitalized in LER text (e.g. MODE ONE)

Defined terms/acronyms/abbreviations appear in parentheses when first used (e.g. Reactor Building (RB)).

EIIS codes appear in square brackets (e.g. Makeup Tank [CB,TK])

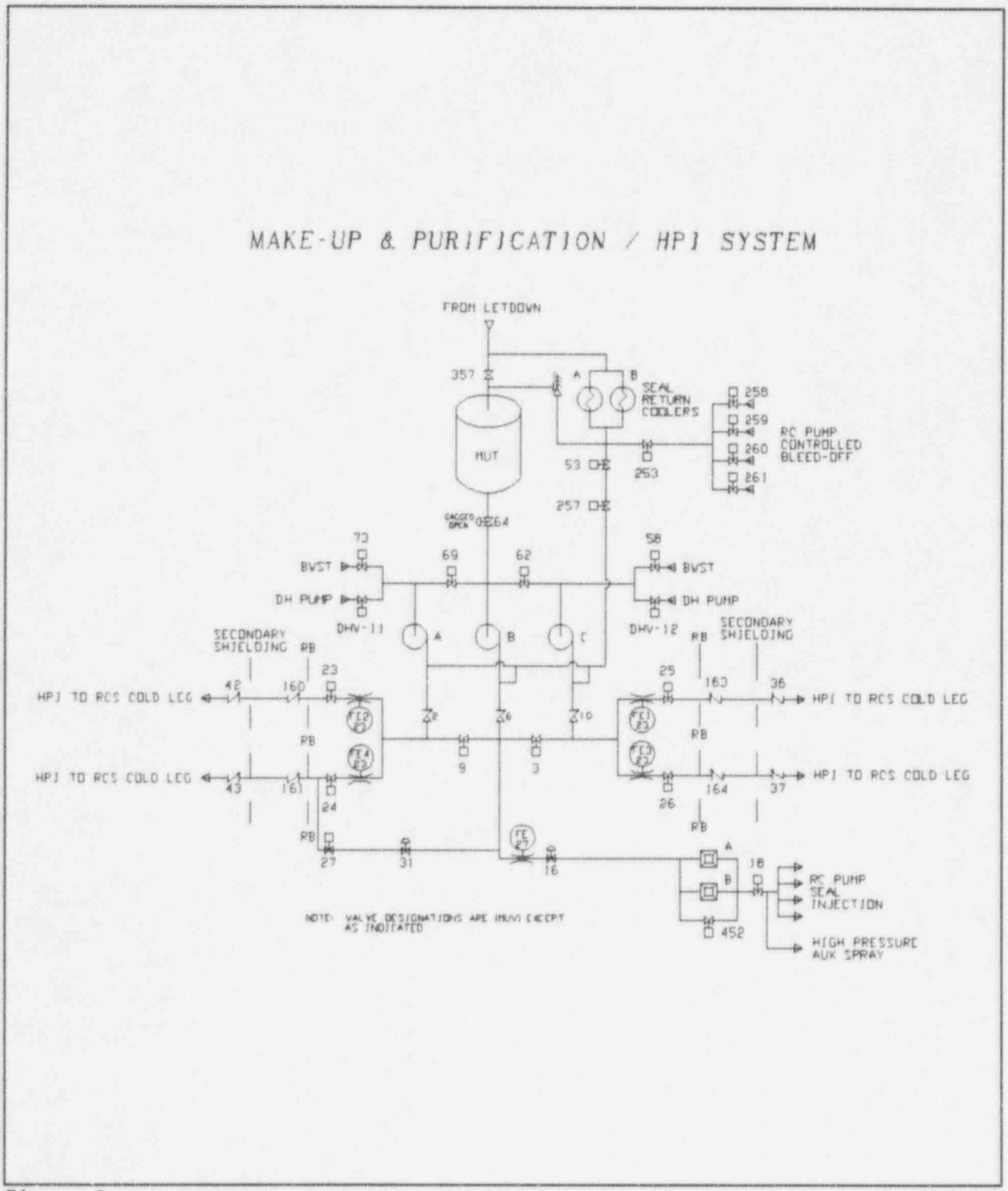
MAKE-UP & PURIFICATION / HPI SYSTEM
FROM LETDOWN
357
A
B
SEAL RETURN COOLERS
258
259
260
261
RC PUMP CONTROLLED BLEED-OFF
MUT
53
253
257
CAGED OPEN
64
70
69
62
58
BVST
DH PUMP
DHV-11
DHV-12
A
B
C
SECONDARY SHIELDING
RB
23
42
160
25
163
36
HPI TO RCS COLD LEG
FE2 F3
FE1 F3
FE4 F3
FE3 F3
8
6
10
9
3
43
161
24
26
164
37
27
31
FE F2
16
18
452
RC PUMP SEAL INJECTION
HIGH PRESSURE AUX SPRAY
NOTE: VALVE DESIGNATIONS ARE (MUV) EXCEPT AS INDICATED

Figure 1