



**Florida
Power**

CORPORATION
Crystal River Unit 3
Docket No. 80-302
Operating License No. DPR-72

October 10, 2000
3F1000-06

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

Subject: LICENSEE EVENT REPORT (LER) 50-302/00-003-00

Dear Sir:

Please find attached Licensee Event Report (LER) 50-302/00-003-00, which discusses the discovery of a condition that is potentially outside the design basis of Crystal River Unit 3 (CR-3). This report is being submitted pursuant to 10 CFR 50.73(a)(2)(ii) and 10 CFR 50.46(a)(3)(ii).

If you have any questions concerning this submittal, please contact Mr. Sid Powell, Manager, Nuclear Licensing at (352) 563-4883.

Sincerely,

T. H. Taylor,
Director
Nuclear Engineering and Projects

THT/jal

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

IE22

LICENSEE EVENT REPORT (LER)

Estimated burden per response to comply with this mandatory information collection request: 50 hrs. Reported lessons learned are incorporated into the licensing process and fed back to industry. Forward comments regarding burden estimate to the Records Management Branch (T-6 F33), 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. If an information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

FACILITY NAME (1)

CRYSTAL RIVER UNIT 3

DOCKET NUMBER (2)

05000302

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TITLE (4)

Reactor Coolant Pump Trip Criteria May Cause Peak Fuel Clad Temperature to Exceed 10 CFR 50.46 Acceptance Criteria

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 NAME
09	11	00	00	-- 003 --	00	10	10	00	DOCKET NUMBER
OPERATING MODE (9)			THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more) (11)						
5			20.2201(b)		20.2203(a)(2)(v)		50.73(a)(2)(i)		50.73(a)(2)(viii)
POWER LEVEL (10)			20.2203(a)(1)		20.2203(a)(3)(i)		X 50.73(a)(2)(ii)		50.73(a)(2)(x)
000			20.2203(a)(2)(i)		20.2203(a)(3)(ii)		50.73(a)(2)(iii)		73.71
			20.2203(a)(2)(ii)		20.2203(a)(4)		50.73(a)(2)(iv)		X OTHER
			20.2203(a)(2)(iii)		50.36(c)(1)		50.73(a)(2)(v)		Specify in Abstract below
			20.2203(a)(2)(iv)		50.36(c)(2)		50.73(a)(2)(vii)		or in NRC Form 366A

LICENSEE CONTACT FOR THIS LER (12)

NAME

John A. Lind, Principal Licensing Engineer

TELEPHONE NUMBER (Include Area Code)

(352) 795-6486

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

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO EPIX

SUPPLEMENTAL REPORT EXPECTED (14)

YES (If yes, complete EXPECTED SUBMISSION DATE).	X	NO
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EXPECTED SUBMISSION DATE (15)

MONTH DAY YEAR

ABSTRACT (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines) (16)

On September 11, 2000, Florida Power Corporation's (FPC) Crystal River Unit 3 (CR-3) was in MODE 5 (COLD SHUTDOWN) at 0 percent Rated Thermal Power. CR-3 was informed by Framatome Technologies Inc. (FTI), that the preliminary results of a revised Small Break Loss of Coolant Accident (SBLOCA) analysis for a Core Flood (CF) line break indicated that the peak fuel clad temperature could exceed the 10 CFR 50.46 (b) limit of 2200 degrees Fahrenheit if the Reactor Coolant Pumps (RCPs) are not assumed to be tripped until two minutes following loss of subcooling margin. Current CR-3 licensing/design basis analyses assumes that with offsite power available, RCPs are shut down no sooner than two minutes after a loss of subcooling margin. On September 15, 2000 at 1038, FPC notified the NRC of this event as a design basis issue under 10 CFR 50.72(b)(1)(ii)(B) and 10 CFR 50.46(a)(3)(ii). The causes were failure to include an analysis of a CF line break with offsite power available in the validation of the two-minute RCP trip criteria for Babcock and Wilcox (B&W) plants, and the use of non-conservative modeling techniques in the current approved CF line break analysis. Corrective actions included determining an acceptable RCP trip window based on the revised analysis and ensuring that current operator response to a loss of subcooling margin supports the new RCP trip criteria.

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TEXT (If more space is required, use additional copies of NRC Form 366A) (17)

DESCRIPTION

On September 11, 2000, Florida Power Corporation's (FPC) Crystal River Unit 3 (CR-3) was in MODE 5 (COLD SHUTDOWN) at 0 percent Rated Thermal Power. During this time, CR-3 was informed by Framatome Technologies, Inc. (FTI) that the preliminary results of a revised Small Break Loss of Coolant Accident (SBLOCA) analysis for a Core Flood [BP] (CF) line break indicated that under certain conditions, peak fuel clad temperature could exceed the 10 CFR 50.46(b) limit of 2200 degrees Fahrenheit.

The current approved CF line break analyses assumptions include a loss of offsite power (LOOP) at the time of reactor trip and a loss of the Emergency Diesel Generator [EK, DG] (EDG) supplying the Emergency Core Cooling System (ECCS) train associated with the intact CF line. Under these conditions, ECCS flow to the core is limited to one Core Flood Tank [BP, TK] (CFT) and the running High Pressure Injection (HPI) pump [BQ, P]. The analyses indicates that this flow, combined with inventory remaining in the Reactor Coolant System [AB] (RCS) based on the early loss of the Reactor Coolant Pumps (RCPs)/forced circulation due to the LOOP, is sufficient to adequately cool the core.

The revised CF line break analysis assumes that offsite power remains available during the event and that the ECCS train associated with the intact CFT is lost due to a postulated failure (e.g., loss of the ES 4160 volt bus). With offsite power available, the RCPs continue to operate until they are tripped by the operators in response to a loss of subcooling margin. With the RCPs running, forced circulation in the RCS causes more liquid to flow out of the break than if the RCPs immediately trip on a LOOP. The results of the revised analysis indicate that the increased RCS inventory loss due to continued forced circulation results in increased core uncover after the pumps are tripped, and that the resulting peak fuel clad temperatures are higher than those identified in previous analyses. If the RCPs are tripped at two minutes after the loss of subcooling margin, the revised analysis indicates that peak fuel clad temperatures exceed the 2200 degrees Fahrenheit acceptance criteria of 10 CFR 50.46(b)(1).

The higher predicted peak fuel clad temperatures for the revised calculation are the result of the assumption regarding availability of offsite power and the use of a revised RCP two-phase performance model. Previous analyses performed by FTI incorrectly assumed that the CF line break with a LOOP was the bounding CF line break event. This assumption was based on FTI's perception that all B&W plants could cross connect Low Pressure Injection [BP] (LPI) lines for immediate accident mitigation. Since the CF line break with a LOOP, was, in turn, bounded by other SBLOCA analyses, FTI further concluded that the existing RCP two-phase performance model was adequate. FTI has subsequently determined that for a CF line break with offsite power available, the pump performance model used in the previous CF line break analyses was non-conservative, e.g., it over-predicted RCP flow degradation during the early portion of a CF line break. The model used in the revised calculation (the lower bound "M3" curve used in the approved large break LOCA model) results in less flow degradation and thus predicts a greater RCS inventory loss prior to the pumps being tripped. The difference in peak fuel clad temperatures between the two pump models is significant. Tripping the RCPs at two minutes using the previous pump model results in a peak fuel clad temperature of approximately 1400 degrees Fahrenheit, as compared to a peak fuel clad temperature in excess of 2200 degrees Fahrenheit indicated by the new model.

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The current CR-3 licensing/design basis analyses assumes that with offsite power available, RCPs are tripped no sooner than two minutes following loss of subcooling margin. Therefore, the preliminary results of the revised analysis for a two-minute pump trip represent a condition that is potentially outside the design basis of CR-3.

EVALUATION

Following notification of the situation described above, FPC requested Framatome to determine an acceptable time limit for tripping RCPs during a CF line break with offsite power available. Using the revised analysis, Framatome determined that tripping the RCPs within one minute of a loss of subcooling margin would result in acceptable peak fuel clad temperatures. Based on recent observations of operator response during SBLOCA simulator exercises, a review of timing data collected during Emergency Operating Procedure (EOP) validation runs conducted in 1997, and discussions with CR-3 simulator instructors, FPC has determined that operator response to a loss of subcooling margin will consistently support a one minute RCP trip criterion. In addition, existing procedural guidance in the CR-3 EOPs directs the operators to trip the RCPs on a loss of subcooling margin. This guidance is an EOP immediate action that is committed to memory by the operators. Based on current procedural guidance, observed and documented operator performance, and the low probability of this specific event ($< 2.4 \text{ E-10}$), FPC has determined that the ECCS remains operable and that this condition is an analytical issue only. Therefore, this condition does not represent a reduction in the level of protection of the public health and safety. This event is not a Safety System Functional Failure.

CR-3 reported this event to the NRC on September 15, 2000 at 1038 prior to startup from a maintenance outage. The report was made under 10 CFR 50.72(b)(1)(ii)(B) as "Any event or condition during operation that results in a condition that is outside the design basis of the plant." Due to the fact that CR-3 was in MODE 5 at the time this condition was identified, the one-hour criteria of this reporting requirement was not in effect.

CAUSE

The cause was personnel error. Calculations were performed by the vendor to determine RCP trip criteria in response to NUREG-0737 Item II.K.3.5. Validation of the current two minute criterion resulting from these calculations did not consider a CF line break scenario, since it was incorrectly assumed that this event was bounded by other SBLOCA events. This conclusion was based on incorrect assumptions by Framatome regarding the ability to cross tie LPI trains during a CF line break, and the use of the non-conservative RCP pump degradation model discussed above to determine RCS inventory at the time the RCPs are tripped. In addition, the B&W Owners Group Analysis Committee and the CR-3 Safety Analysis Group accepted the vendor analysis and bounding assumptions without a detailed review based on the vendor's Quality Assurance Program meeting the requirements of 10 CFR 50 Appendix B.

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IMMEDIATE CORRECTIVE ACTIONS

1. FPC requested Framatome to determine an acceptable RCP trip window using the revised analysis. Framatome has determined that tripping the RCPs within one minute of a loss of subcooling margin will result in acceptable peak fuel clad temperatures for a CF line break.
2. FPC determined that the actual time required by the operators to trip RCPs following a loss of subcooling margin was consistently less than the one minute limit. This conclusion was based on the observed response of operating crews during recent requalification training, timing data collected during multiple EOP validation sessions conducted in 1997, and discussions with the simulator training staff.
3. Operations personnel were informed of this condition, and expectations for immediately tripping RCPs following a loss of subcooling margin were reiterated with operating personnel.
4. A Condition Resolution Report was generated to evaluate ECCS operability. The Report concluded that the ECCS remains operable, and that restart and continued operation could be authorized based on CR-3's implementation of the guidance provided in Generic Letter 91-18, Revision 1.
5. Precursor Card 00-2487 was written to identify this issue and track it to final resolution.

ACTIONS TO PREVENT RECURRENCE

1. Framatome will reanalyze CR-3 specific SBLOCAs using the revised pump degradation model to determine the effects on peak fuel clad temperatures. This action is scheduled for completion by December 20, 2000.
2. It is anticipated that a change to the CR-3 Licensing Basis will be required to resolve this issue. The specific change will be determined based on the results of the Framatome re-analyses discussed above.
3. FPC is participating in an audit at Framatome during October 2000. The audit is focusing on the Framatome Quality Assurance program as it relates to analysis and calculation validation activities. Corrective actions including lessons learned from this event will be incorporated into future vendor audit activities.

PREVIOUS SIMILAR EVENTS

There has been one previous event involving 10 CFR 50.46 acceptance criteria being exceeded as a result of vendor personnel error. On March 17, 1995, FPC issued LER 95-003-00 to report an error in the initial conditions used for Large Break Loss of Coolant Accident (LBLOCA) analyses. The LER identified that assumptions made for the initial conditions of CFT inventory and pressure were not the most limiting, and that non-conservative data was used in the fuel pin thermal analysis. Correction of

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these errors resulted in a peak fuel clad temperature above the 2200 degrees Fahrenheit limit of 10 CFR 50.46(b)(1); however, the operating limits in effect at CR-3 at the time of the event were more conservative than those that would have been required by the corrected analysis.

ATTACHMENTS

Attachment 1 - Abbreviations, Definitions, and Acronyms
Attachment 2 - List of Commitments

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ATTACHMENT 1**ABBREVIATIONS, DEFINITIONS, AND ACRONYMS**

10CFR	Title 10 of the Code of Federal Regulations
B&W	Babcock and Wilcox
CFT	Core Flood Tank
CR-3	Crystal River Unit 3
ECCS	Emergency Core Cooling System
EDG	Emergency Diesel Generator
EOP	Emergency Operating Procedure
ES	Engineered Safeguards
FTI	Framatome Technologies Inc.
FPC	Florida Power Corporation
HPI	High Pressure Injection
LBLOCA	Large Break Loss of Coolant Accident
LER	Licensee Event Report
LOOP	Loss of Offsite Power
LPI	Low Pressure Injection
LOCA	Loss of Coolant Accident
RCP	Reactor Coolant Pump
RCS	Reactor Coolant System
SBLOCA	Small Break Loss of Coolant Accident

Note: Improved Technical Specifications terms appear in capitalization in the text of the LER. EIS Codes appear in square brackets. Defined terms / acronyms / abbreviations appear in parentheses when first used.

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ATTACHMENT 2

List of Commitments

RESPONSE SECTION	COMMITMENT	DUE DATE
	No regulatory commitments are made in this submittal.	