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

January 20, 1995
3F0195-12

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

Subject: Licensee Event Report (LER) 94-013-00

Dear Sir:

Enclosed is Licensee Event Report (LER) 94-013-00 which is submitted in accordance with 10 CFR 50.73.

Sincerely,

Gary Boldt

G. L. Boldt
Vice President
Nuclear Production

GLB/JAF:ff

Attachment

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

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CRYSTAL RIVER ENERGY COMPLEX: 15760 W Power Line St • Crystal River, Florida 34428-6708 • (904) 795-6486
A Florida Progress Company

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 5

TITLE (4)

Marine Organism Biofouling Causes Heat Exchanger Partial Blocking and Potential for Operation Outside Design Basis

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 9	1 3	9 4	9 4	0 1 3	0 0	0 1	2 0	9 5	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)	50.73(a)(2)(v)	73.71(c)
		20.405(a)(1)(ii)	50.36(c)(2)	50.73(a)(2)(vii)	X 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
J. A. Frijouf, Nuclear Regulatory Specialist	9 0 4 5 6 3 - 4 7 5 4

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 September 13, 1994, Florida Power Corporation's (FPC) Crystal River Unit 3 (CR-3) was in MODE ONE (POWER OPERATION), operating at 100% reactor power and generating 872 megawatts. FPC personnel determined that they were unable to conclusively assure continuous operation within the design basis (DB) as a result of previous occurrences of raw water heat exchanger partial plugging and fouling. FPC cannot conclusively prove that CR-3 had, at all times, remained within the DB.

The cause of the heat exchanger fouling is due to marine organism growth. A series of corrective actions are being implemented to minimize the impact of heat exchanger performance due to marine organism biofouling.

On December 20, 1994 as a result of an evaluation of this issue, FPC management determined that this issue should be reported as a voluntary Licensee Event Report (LER) under 10CFR50.73.

EVENT DESCRIPTION:

On September 13, 1994, Florida Power Corporation's (FCC) Crystal River Unit 3 (CR-3) was in MODE ONE (POWER OPERATION), operating at 100% reactor power and generating 872 megawatts. At 1400, in preparation for a Service Water System Operational Performance Inspection Self Assessment (SWSOPA), FCC personnel determined that they were unable to conclusively assure continuous operation within the design basis (DB) as a result of raw (sea) water heat exchanger [KE,HX](SWHE) partial plugging and fouling.

In normal operation, three Nuclear Service Closed Cycle Cooling (SW) heat exchangers (SWHE) are in operation while the fourth, usually the most recently cleaned heat exchanger, remains in standby. (see Figure 1 - SW System Simplified Functional Flow Diagram) One of the concerns involves the fact that a clean SW heat exchanger, at times, is required to be placed in operation in order to achieve a baseline flow rate (within a narrow tolerance) required to perform the SW raw water pumps [BS,P](RWP) surveillances. The pump flow surveillances are used to verify the capability of the pumps to pass their required flows in accordance with ASME Sect. XI, and not necessarily a measure of the systems ability to remove the required heat. The inclusion of an additional heat exchanger to achieve the required flow for the surveillance acceptance criteria indicates some heat exchanger blockage has occurred. This affects the assurance that the SWHEs can remove their DB heat load.

Another concern identified has been the substantial level of blockage occasionally observed during the cleaning of the SWHEs. This level has at times reached 80% of the tubes blocked in a single SWHE. FCC conservatively defines a "blocked tube" to be a tube observed to have any detectable level of foreign material or debris obstructing flow through the tube (e.g. A heat exchanger with tubes 100% blocked may still allow a substantial level of flow relative to a clean heat exchanger).

FCC has implemented a program of frequent regular heat exchanger maintenance to combat the problem of heat exchanger fouling and flow blockage in the Nuclear Service and Decay Heat Raw Water (RW) system. This program includes cleaning and inspecting the intake canal and RW pits, and cleaning and shooting each SWHE every 28 days (one heat exchanger each week). These programs address the problem of marine organism biofouling after the growth has occurred and do not consider any growth control programs. The programs previously in place may not have provided sufficient assurance that marine organism biofouling was maintained at levels low enough to remain within acceptable margins to ensure continuous system operability.

FCC cannot conclusively prove that CR-3 had, at all times, remained within the DB. On December 20, 1994 as a result of a management review team evaluation of the SWSOPA issues, FCC management determined to report this event as a voluntary Licensee Event Report (LER) under 10CFR50.73.

EVENT EVALUATION

The RW system provides a heat sink for the SW system via four heat exchangers (SWHEs). Three out of four SWHEs are in operation at any time. The SW system provides safety functions of supplying component cooling water for heat removal following a DB accident. Redundancy to the safety functions of the SW system are provided by the reactor building (RB) spray system, which provides RB cooling in lieu of the RB fan/coolers, and the DC system which assures key heat removal functions are maintained.

The current issue, RW system flow reduction due to marine organism biofouling and SWHE tube blockage, would not disable the SW system. The reduced rate of heat rejection could cause the SW supply temperature to approach or potentially exceed its DB maximum temperature. In a hypothesized worst case scenario, the reduced RW flow to the SWHEs as a result of substantial SWHE tube blockage could result in some components cooled by SW to overheat as a result of the reduced SWHE heat transfer.

The likelihood of such challenges and the limited frequency of very high flow blockage mitigate the probability of actual operation outside the DB. Further, the availability of the fourth heat exchanger and the availability of other systems also reduces the safety impact. Therefore, this event did not compromise the health and safety of the general public.

CAUSE

The primary cause of the heat exchanger fouling is due to loose marine organism growth originating in the intake, flumes, and RW pits. The programs previously in place to maintain the pits may not have provided sufficient assurance that marine organism biofouling was maintained at levels low enough to remain within acceptable margins to ensure continuous system operability.

CORRECTIVE ACTION

An extensive series of corrective actions have been developed to address the problem of marine organism biofouling and blockage of heat exchangers, by means of both marine organism growth control and removal. These corrective actions include the following.

1. The RW system is being addressed as part of a biofouling study. This study is evaluating methods of controlling marine organism biofouling by chemical and mechanical methods.

2. The frequency of RW pit inspection and cleaning has been significantly increased.

3. An analytical basis for the determination of SWHE performance based on the percentage of blocked tubes versus the ultimate heat sink (UHS) temperature has been developed. A revision to the calculation is currently in process. This revision will contain a family of curves representing various cleanliness factors. Factors to be considered in the development of the curves will include actual UHS temperature, system flow rates and number of plugged tubes. The applicable procedures will be reviewed and revised to reflect new requirements as they are established.

4. Based on the previously described calculation, instructions have been developed to direct additional SWHEs to be cleaned if the one being cleaned is found to contain debris exceeding a predetermined limit. The amount of debris and the UHS temperature determine when additional SWHEs are cleaned.

PREVIOUS SIMILAR EVENTS

There has been one previous reportable event involving the heat removal capacity of cooling systems at CR-3. LER 87-020-02 addressed an event in which the ultimate heat sink (Gulf waters) exceeded the DB temperature.

ATTACHMENT

Figure 1 - SW system Simplified Functional Flow Diagram

LICENSEE EVENT REPORT (LER)
TEXT CONTINUATION

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TEXT *(If more space is required, Use additional NRC Form 366A's (17)*