Florida Power
CORPORATION

April 6, 1982
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Mr. Harold R. Denton, Director
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Subject: Crystal River Unit 3
Docket No. 50-302
Operating License No. DPR-72
Operation at 2300 MWt with Pump Power Monitors Bypassed

Dear Mr. Denton:

Florida Power Corporation hereby requests authorization to operate Crystal River Unit 3 at power levels up to 2300 MWt (90.4% Full Power) with the Reactor Coolant Pump Power Monitors bypassed. Enclosed as part of this request is supporting documentation which shows that DNBR criteria will not be violated (at this power level) for the worst case Reactor Coolant Pump coastdown event. Scaling of the Power Range Nuclear Instruments to read 2300 MWt equal to 100% Full Power is required to validate the analyses supporting this request.

Continued operation at 75% Full Power versus 90% Full Power causes a significant economic hardship for Florida Power and offers no apparent benefits. We, therefore, request an expedited review of this request.

Very truly yours,

David G. Mardis

David G. Mardis
Acting Manager
Nuclear Licensing

EWF:mm

cc: Mr. J. P. O'Reilly, Regional Administrator
Office of Inspection & Enforcement
U.S. Nuclear Regulatory Commission
101 Marietta Street N.W., Suite 3100
Atlanta, GA 30303

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J. A. Castanes, Product Management	BWNP-2055317
K. D. Tuley, Safety Analysis (Ext. 2692)	Customer or File
Requirements For FPC Cycle 4 Operation Without the Pump Status Trip	Date: March 8, 1982

This memo specifies the RPS requirements for FPC Crystal River-3 Cycle 4 operation without the pump status trip. Recent licensing activities regarding the pump status trip have impeded FPC full power operation. Operation without taking credit for the pump status trip could provide some relief, permitting continued operation at a lower power level. This memo summarizes the requirements necessary for this reduced power operation, taking no credit for the pump status trip. The memo will address a summary of requirements, the revised RC flow protection philosophy, the limiting transient analysis results, and a discussion of the requirements.

KDT/msm

Attachment

Summary of Requirements

(1) The pump status trip will not be assumed for any transient or steady-state protection.

(2) All RC flow coastdown protection will be provided by the power/imbalance/flow trip.

(3) The Reactor Operator will be required to prevent 2, 1 or 0 RC pump operation, as per FPC Tech. Spec. Section 3.4.1.

(4) Rated thermal power will be limited to 2300 MW_{th}. The neutron flux instrumentation in the RPS (all channels, all trips) will be calibrated such that 100% FP neutron power equals 2300 MW_{th} heat balance power.

(5) The flux/flow ratio of the power/imbalance/flow trip will be maintained at or below 1.07, as given in Figure 2.2-1 of FPC Tech. Specs. Amend. 46. The power/imbalance setpoints of this trip will be maintained at the values specified in the Amend. 46 Figure 2.2-1.

Revised RC Flow Protection Philosophy

The original Cycle 4 RC flow protection philosophy was presented in Reference 2, and addressed the protection provided by the two RPS trips power/imbalance/flow and pump status. The reference noted both transient and steady-state protection, with this original transient protection summarized in Table 1.

The revised Cycle 4 RC flow protection philosophy relies only on the power/imbalance/flow trip for all RC flow-related protection, both steady-state and transient. The only change from the original Cycle 4 philosophy, is that for transient protection, the flux/flow ratio will provide protection for all RC pump coastdown accidents. As the 2/2 → 0/0 pump coastdown accident is limiting (i.e., fastest flow reduction of all coastdown events, see Ref. 1 for confirmation),

this accident will be used to deterime limitations on the flux/flow setpoint or the transient initial power level. The revised Cycle 4 RC flow protection philosophy is summarized in Table 2. Also, as discussed in Reference 2, only the power/imbalance/flow trip provides steady-state protection, so that the lack of a pump status trip does not impact steady-state protection. It should be noted, however, that the operator will be required to prevent 2, 1 or 0 pump operation, as required in FPC Tech. Spec. Section 3.4.1.

Limiting Transient Analysis Results

As noted in the "Philosophy" section of this memo, the 2/2 → 0/0 pump coastdown accident is limiting when flux/flow trip protection is required for all coastdown events (i.e., when the pump status trip is not used). An analysis of a Cycle 4 4 pump coastdown (4PCD) event relying only on flux/flow trip protection, was generated in Reference 1, and these results will now be reviewed.

The Reference 1 analysis assumed the standard 4PCD event with two exceptions: (1) the value of S_m (the analysis flux/flow ratio - see Ref. 3) remained at a value of 1.13%FP/% flow (giving a Tech. Spec. flux/flow ratio of 1.07%FP/% flow--see Reference 4), and (2) the initial power level was varied, so that minimum DNBR (MDNBR) could be plotted against initial power level, still assuming S_m = 1.13. The reference recommends an initial power level of 2300 MW_{th}, yielding a MDNBR $\underline{\sim}$ 1.43 for the 4PCD with S_m = 1.13 (see Figure 1). The limit on DNBR for FPC Cycle 4 is 1.35 (see Reference 1), so the 2300 MW_{th} initial power level with S_m = 1.13 yields acceptable results. It should be noted that 2300 MW_{th} is the assumed rated thermal power; analysis of transients using the flux/flow trip normally assume neutron flux and ICS errors in the analysis initial power level. If the plant initial power level is 100% FP, the transient analysis would assumed 108%FP (see References 1 and 3), yielding, for the FPC 4PCD, 108 x 2300 = 2484 MW_{th} analysis initial power level.

MINIMUM DNBR FOR FSC CY-4 FOUR PUMP COASTDOWN USING FLUX/FLOW TRIP

ASSUMPTIONS:

- ANALYSIS FLUX/FLOW TRIP SETPOINT = 1.13 %FP/% FLOW
- ANALYSIS INITIAL POWER LEVEL = 1.05 × PLANT INITIAL POWER LEVEL

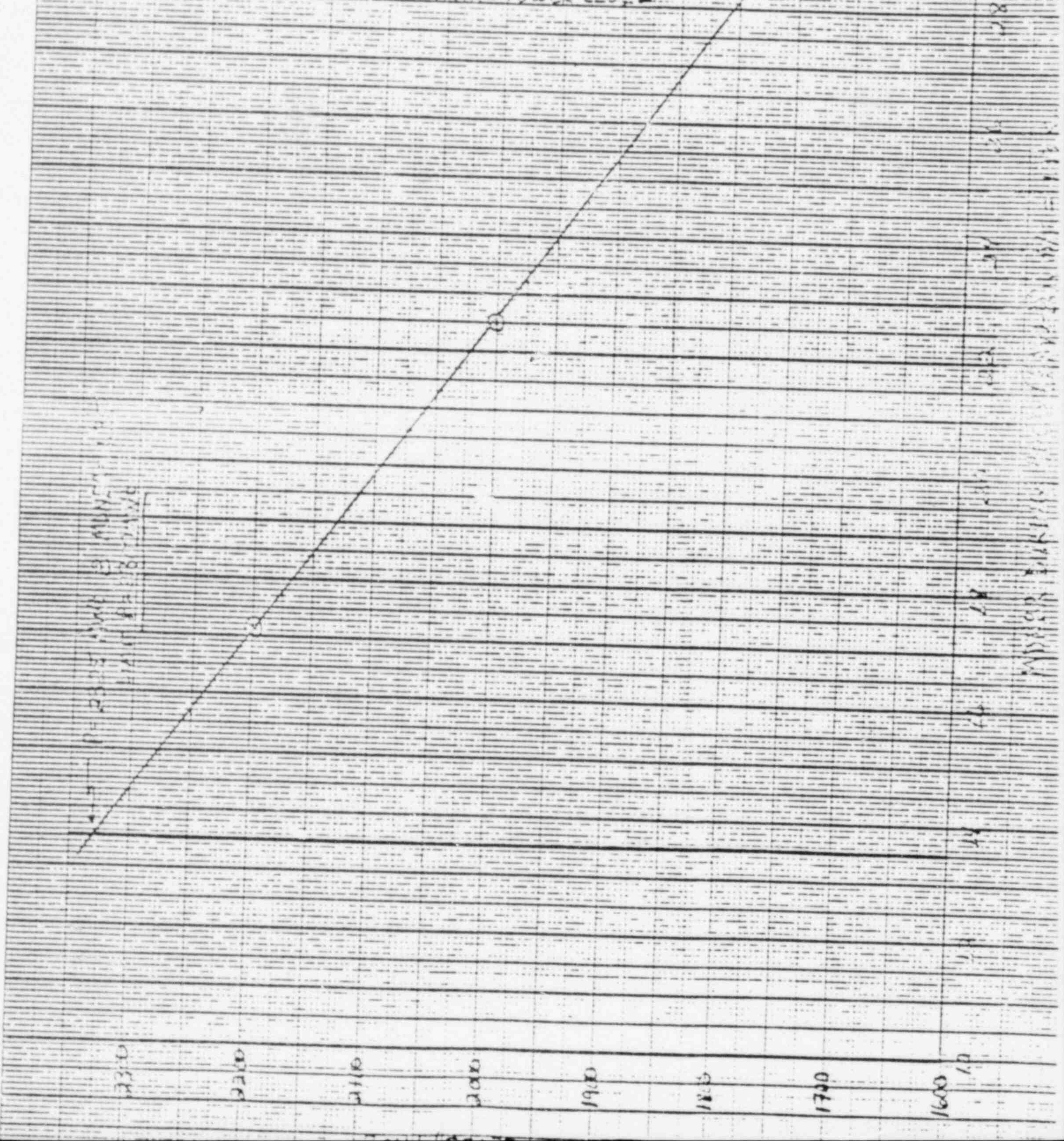

TABLE 1

ORIGINAL CYCLE 4

MATRIX OF RC FLOW REDUCTION ACCIDENT PROTECTION

(ASSUMING PUMP STATUS TRIP OPERABLE)

FOR CRYSTAL RIVER-3

ACCIDENT	RPS TRIP PROTECTION
RC Pump Coastdown	
2/2 → 2/1	flux/flow ratio of power/imbalance/flow
all other coastdowns	pump status
All Locked Rotor Accidents**	flux/flow ratio of power/imbalance/flow

*2/2 denotes 4 pump status with 2 pumps operating in both steam generator loops.

**177 FA plants currently do not analyze the sheared shaft event, but tactically assume this event is bounded by the locked rotor event. If shear shaft protection were specified, it would be provided by the flux/flow ratio.

TABLE 2

REVISED CYCLE 4

MATRIX OF RC FLOW REDUCTION ACCIDENT PROTECTION

(ASSUMING NO PUMP STATUS TRIP)

FOR CRYSTAL RIVER-3

ACCIDENT	RPS TRIP PROTECTION
RC Pump Coastdown Accident	
2/2 → 0/0 †	flux/flow ratio of power/imbalance/flow
all other coastdowns	flux/flow ratio of power/imbalance/flow
All Locked Totor Accidents**	flux/flow ratio of power/imbalance/flow

*2/2 denotes 4 pump status with 2 pumps operating in both steam generator loops.

**177 FA plants currently do not analyze the sheared shaft event, but tactically assume this event is bounded by the locked rotor event. If shear shaft protection were specified, it would be provided by the flux/flow ratio.

†This protection may require flux/flow setpoint reduction and/or power derating to provide acceptable DNBR protection.

To summarize these results, the transient analysis assumed a 2300 MW_{th} rated power with the computer code analysis using 2484 MW_{th}, S_m = 1.13, S_{ew} = 1.07, and the resulting DNBR was 1.43, above the 1.35 limit.

Discussion of Requirements

Requirement 1 - Purpose of file

Requirement 2 - As noted in "Philosophy" section, the flux/flow ratio will supplant the transient protection previouslt provided by the pump status trip.

Requirement 3 - The pump status trip prohibits operation in 2, 1 or 0 RC pump status. As the pump status trip will no longer be assumed for any protection, the reactor operator must be cognizant for ensuring that the plant does not operate in 2, 1 or 0 pump status, and that the operator will manually ensure that Tech. Spec. Section 3.4.1 is not violated.

Requirement 4 - The execution of an RPS trip is an exercize in evaluating the relationships of the generated voltage signals. The limiting transient analysis made assumptions concerning the RPS calibration and the execution of the flux/flow trip based upon perceived flux and flow values. Failure to calibrate flux to 100% FP (or $\sim$ 8.0 volts in the 0-10 volt range) at 2300 MW_{th} heat balance power will alter the calculated event consequences of the 4PCD.

Requirement 5 - The flux/flow ratio setpoint is a similar analysis assumption, necessary to ensure acceptable event consequences. With a 1.07 flux/flow ratio, a timely reactor trip will be actuated, generating the acceptable 4PCD consequences discussed in the "Limiting Transient Analysis" section. Higher values of the flux/flow ratio setpoint could result in more severe 4PCD event consequences, as discussed in Requirement 4. Maintaining the power/imbalance setpoints ensures conservative steady-state DNBR and kW/ft protection, as noted in Reference 4.

REFERENCES:

1. M.D. Walz to K.D. Tuley, "Operation Without Pump Monitors," 86-1131326-00, 660-083D, 3/25/82.

2. K.D. Tuley, "FPC RPS Requirements for RC Flow-Related Trips," 51-1128452-02, 585-7087, 1/18/82.

3. K.D. Tuley, "FPC Ø/W Setpoint Error Adjustment," 51-1132039-00, 660-083D, 3/30/82.

4. R.H. Ellison, "RPS Setpoint Verification for 2300 MWt for CR-III Cy 4," 32-1132041-00, 660-082D, 3/30/82.