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SEP 6 1983

Docket No. 50-302

Mr. Walter S. Wilgus
Vice President, Nuclear Operations
Florida Power Corporation
ATTN: Manager, Nuclear Licensing
& Fuel Management
P. O. Box 14042; M.A.C. H-2
St. Petersburg, Florida 33733

Dear Mr. Wilgus:

In response to an NRC "Order for Modification of License" dated December 10, 1982, Florida Power Corporation (FPC) proposed an instrumentation system to detect inadequate core cooling at Crystal River Unit 3. Your proposals were embodied in responses dated April 15, April 25 and July 18, 1983. The proposed system would utilize differential pressure measurements to monitor coolant inventory in each hot leg and in the reactor vessel head, reactor coolant pump power and inlet temperature monitors, core exit thermocouples and subcooling margin monitors. The correspondence indicated above proposes an installation schedule which would be completed in April 1985.

The NRC staff has completed an evaluation of the proposed system and finds that the proposed concept to be used for the coolant inventory tracking system provides a satisfactory basis for FPC to proceed with final design engineering and procurement. However, the staff has identified some concerns which should be considered during the final design process and which may require design modifications in order to resolve those concerns.

Enclosure 1 to this letter is the staff's evaluation of the FPC responses to the subject order using the criteria of NUREG-0737, Item II.F.2. Enclosure 2 is a request for additional information regarding this system. Enclosure 3 is a listing of required milestones for implementation of this system.

Your response to this letter is requested within 30 days of receipt and should include, as a minimum, a schedule for additional submittals to address the staff's concerns. FPC should proceed with actions necessary to meet the 1985 installation schedule.

OFFICE ▶	.....	.....	.....	.....	.....	.....	.....
SURNAME ▶	.....	.....	.....	.....	.....	.....	.....
DATE ▶	.....	.....	.....	.....	.....	.....	.....

The reporting and/or recordkeeping requirements contained in this letter affect fewer than ten respondents; therefore, OMB clearance is not required under P.L. 96-511.

Sincerely,

Original signed by
John F. Stolz, Chief
Operating Reactors Branch #4
Division of Licensing

Enclosures:
As Stated

cc w/enclosures:
See next page

OFFICE	ORB#4:DL	C-ORB#4:DL					
SURNAME	RHernan;cf	JStolz					
DATE	9/6/83	9/6/83					

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

September 6, 1983

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Mr. Walter S. Wilgus
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John F. Stolz, Chief
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Division of Licensing

Enclosures:
As Stated

cc w/enclosures:
See next page

Crystal River Unit No. 3
Florida Power Corporation

cc w/enclosure(s):
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ENCLOSURE 1

EVALUATION OF FLORIDA POWER CORPORATION RESPONSE TO
"ORDER FOR MODIFICATION OF LICENSE"
DECEMBER 10, 1982

NUREG-0737 ITEM II.F.2 FOR CRYSTAL RIVER NUCLEAR PLANT UNIT 3
DOCKET NO. 50-302

The staff in conjunction with our contractor, Oak Ridge National Laboratory (ORNL), has reviewed the Florida Power Corporation (FPC) submittals dated April 15, April 25, and July 18, 1983, in response to the subject order. Crystal River Unit 3 has a B&W Nuclear Steam Supply System. In its submittals, Florida Power Corporation has proposed differential pressure measurements to monitor the coolant inventory in each hot leg, and to monitor the coolant inventory in the reactor vessel head. Reactor coolant pump power measurements will be used to monitor coolant inventory while the reactor coolant pumps are running.

A tap on the decay heat drain line serves as a common lower attachment point for all dp measurements in the reactor coolant inventory monitoring system. The upper connections on the hot leg systems are provided by taps on the hot leg vents at the top of the candy canes on each train. To maintain the impulse lines to the top of the hot legs full, seal chambers are to be located at the high point of each hot reference leg. The tap into the reactor vessel will require replacement of a control drive mechanism.

The coolant inventory system proposed by FPC includes a means to track inventory with the reactor pumps running by monitoring the reactor pump power and pump inlet temperatures. The system will have a limited range of 15 to 40 percent void-fraction. FPC has justfied the pump power monitoring design deviation from NUREG-0737 environmental qualification/Class 1E power source as follows:

(1) reactor coolant pumps (RCPs) motor and their associated electrical

circuits currently are powered from non-Class 1E sources and are not environmentally qualified in accordance with IEEE 323-1974;

(2) the reactor coolant inventory tracking system (RCITS) is not a protection system, but a monitoring system with reliable backup from the CET and SMM;

(3) upgrading cost in terms of financial expenditure, downtime and man/rem exposure would be exorbitant;

(4) separate sets of analog computational devices will be used for each RCP loop and 100% computational backup will be provided by the computer.

Two independent subcooling margin monitors (SMM) are already installed and have digital displays located on the main control board. These instruments acquire the hot leg (T_h) and cold leg (T_c) temperatures and the reactor pressure at each loop to calculate the corresponding saturation temperature (Tsat). Each monitor displays the degrees of subcooling of one loop continuously and the degrees of subcooling of the other loop on demand.

In addition to T_h and T_c, the hottest CET selected from a group of six is connected to each SMM. These 12 CETs have been selected to provide representative temperatures from each core quadrant and the central region. The hottest CET temperature over a range of 0° to 1,023°F is displayed on demand. Tsat corresponding to the hottest CET also is displayed on demand. The instruments include a low margin to saturation alarm indicator and an alarm signal to the plant annunciator and event recorder. Verification of SMM meter operability is performed semiannually by performing a calibration using Surveillance Procedure SP-122.

The primary operator display of CETs is provided by a core map diagram on the plant computer CRT monitor. The diagram includes all 52 CET temperature readings over a range of 0° to 900°F. Any temperature exceeding a high alarm limit (700°F) is alarmed and the hottest temperature is highlighted in color.

Alarmed values flash in red until acknowledged by the operator. A printed hard copy of the core may be requested by the operator. An independent and separate recording system provides alarming capability for all 52 CETs. A printed record of all CET temperatures over a range of -35° to 2,490°F is available on demand.

Three multipen analog temperature recorders will be provided on the main control board. A minimum of 16 CETs, 4 from each core quadrant, will be recorded continuously over a range of 0°F to 2,500°F. The recorders will have alarm capability, can automatically change chart speed on alarm, and will detect inoperable CETs.

The existing CETs, connectors, and cables are not environmentally qualified category 1E devices. Isolation and separation are not provided. FPC has committed that during the next refueling outage (1985), all of the existing in-containment cable for the in-core probe assemblies will be replaced with qualified cable. Also, during future outages, the incore probe assemblies will be replaced with qualified units.

The installation of the hot leg level measurement system is scheduled for the refueling outage in the Spring of 1985. The licensee indicates 90% confidence that the installation can be completed by this date. If, due to late delivery of components the installation cannot be completed by this date, FPL indicates 100% confidence that the system can be fully installed by the next refueling outage in the Fall of 1986.

Evaluation of Proposed Concepts and Implementation Schedule

The approach described by Florida Power Corporation for the design development and implementation of an inventory tracking system for Cyrstal River Unit 3 provides a satisfactory basis for the licensee to proceed with the engineering design to meet the proposed installation schedule. However, the staff has identified some concerns which must be considered during the final design and which may require design modifications in order to resolve those concerns.

One concern relates to the potential vulnerability of the entire coolant inventory system of differential pressure measurements to a single failure of the lower tap on the decay heat drain line. The licensee has acknowledged this concern and intends to take design precautions to minimize the vulnerabilty. We have also noted the operator is expected to recognize invalid readings on the dp coolant inventory system by referring to operational procedures. There should be some label or alarm indicator located near the inventory indicators that would warn the operator that the indications of the inventory system are not valid.

The staff has reviewed the licensee's justification for pump power monitor design deviations from the NUREG-0737 Item II.F.2 requirements. While we agree that it is not necessary to provide a Class 1E design for instrumentation which monitors the power for operation of non-Class 1E pump motors and electrical circuits, we believe that design of the monitoring instrumentation should assure that it remains functional under environmental conditions which would not preclude operation of the pumps. It is conceivable that pumps may be restarted in the late stages of a loss of coolant accident in order to improve core cooling under low inventory conditions. The void fraction should then be monitored to evaluate coolant recovery efforts. The licensee should evaluate the power monitor design with respect to this capability. In addition, the staff will require additional information to support the validity of the pump power versus void correlations.

Based on our review of the proposed systems for subcooling margin monitoring and core exit thermocouples, we find that the proposed systems and modifications are acceptable pending clarification in response to Question 11 in Enclosure 2.

The licensee schedular commitments in response to Generic Letter 82-28 (i.e., complete all ICC instrument installation and upgrading during the Spring of 1985 refueling outage) is acceptable. However, the licensee has also indicated that the confidence level of making the system operational by the end of the subsequent operating cycle is 90%. The licensee should avoid slippage of the expected schedule and should notify the NRC immediately of any factors which appear to be impacting the schedule. The NRC staff must approve a revised ATOG procedure

which incorporates guidance on the use of the total ICCI system before the licensee can turn the system on. The staff must also approve the final design implementation. The milestones relating to implementation of the system as required by Generic Letter 82-28 are provided in Enclosure 3 and should be incorporated into the Crystal River Unit 3 schedule.

ENCLOSURE 2

REQUEST FOR ADDITIONAL INFORMATION FPC PROPOSED INADEQUATE CORE COOLING INSTRUMENTATION FOR CRYSTAL RIVER NUCLEAR PLANT UNIT 3

1. Provide a detailed analysis of the measurement errors in the hot leg level measurement. This analysis should include, besides the overall estimate of the measurement uncertainty, a table with estimates of error, including limits of uncertainty for each contributing factor, i.e., temperature of the impulse lines, common mode pressure effects on the differential pressure transducer, and uncertainties associated with the transducer. Explain how the individual errors were combined for the estimate of the overall error. Include a copy of the specifications for the proposed dp transducers.

2. Provide an analysis of the error that would be expected both with and without temperature compensation on the vertical runs of the hot leg measuring system.

3. Suppose an impulse line on one hot leg was broken such that it would tend to drive the dp transducer full scale. How would this condition be detected?

4. Provide additional details of the seal chambers on the reference legs of the hot leg level measuring system including a drawing showing the proposed installation.

5. Provide an analysis to show the effects of flashing or dissolved gasses in the impulse lines.

6. Discuss the vulnerability of the differential pressure transmitters located in containment. In particular, discuss the ability of the transmitters to withstand a LOCA environment within the containment and be available for post-accident monitoring--consider the loss of the pressurizer transmitters in the TMI-II accident in this discussion.

7. Describe the location of an indication of the state of the reactor pumps with respect to the location of the inventory readouts in the control room.

8. Discuss the tap in the decay heat drain line from the standpoint of a single failure of a line leading to this tap. Consider potential consequences of such a failure and provide details of design precautions to prevent such a failure.

9. Describe how the differential pressure measuring system is protected against over pressure during venting or while the reactor pumps are operating.

10. With reference to the discussion of invalid indications by the dp coolant inventory systems under item 12 on p. 4: describe the relative locations of the coolant inventory system indicators with respect to indications of the reactor pump status.

11. In the July 18, 1983 submittal the licensee states thermocouples, connectors and cable are not at present environmentally qualified. It is further stated that in the future environmentally qualified cable and thermocouples will be installed. Clarify that qualified connectors and penetration devices will also be used.

12. Provide more detail on the pump power versus void correlation with the supporting test data and the referenced Babcock & Wilcox Document No. 77-1137950-00, October 1982, entitled "Feasibility Study of Inventory-Trending Methods with RC Pumps Operating." Describe how the data shows that the signal is reliable between 15 and 40 precent void fraction. Has degraded pump performance under two phase flow conditions been accounted for?

13. Your justification for use of non-safety grade pump power monitoring channels is based in part on the argument that the RCP motor and their associated electrical circuits are powered from non-Class 1E sources and are not environmentally qualified. However, it is conceivable that pumps may be restarted for improved core cooling late in an ICC transient after the core has uncovered. Provide assurance that the pump monitoring channels are at least as reliable as the RCP motor and electrical circuits and can be expected to function in an environment which will permit RCP restart.

ENCLOSURE 3

MILESTONES FOR IMPLEMENTATION OF

INADEQUATE CORE COOLING INSTRUMENTATION

1. Submit final design description (by licensee) (complete the documentation requirements of NUREG-0737, Item II.F.2, including all plant-specific information items identified in applicable NRC evaluation reports for generic approved systems).

2. Approval of emergency operating procedure (EOP) technical guidelines - (by NRC).

   Note: This EOP technical guideline which incorporates the selected system must be based on the intended uses of that system as described in approved generic EOP technical guidelines relevant to the selected system.

3. Inventory Tracking Systems (ITS) installation complete (by licensee).

4. ITS functional testing and calibration complete (by licensee).

5. Prepare revisions to plant operating procedures and emergency procedures based on approved EOP guidelines (by licensee).

6. Implementation letter* report to NRC (by licensee).

7. Perform procedure walk-through to complete task analysis portion of ICC system design (by licensee).

8. Turn on system for operator training and familiarization.

9. Approval of plant-specific installation (by NRC).

10. Implement modified operating procedures and emergency procedures (by licensee).

- System Fully Operational -

*Implementation Letter Report Content

(1) Notification that the system installation, functional testing, and calibration is complete and test results are available for inspection.

(2) Summary of licensee conclusions based on test results, e.g.:

   (a) the system performs in accordance with design expectations and within design error tolerances; or

   (b) description of deviations from design performance specifications and basis for concluding that the deviations are acceptable.

(3) Description of any deviations of the as-built system from previous design descriptions with any appropriate explanation.

(4) Request for modification of Technical Specifications to include all ICC instrumentation for accident monitoring.

(5) Request for NRC approval of the plant-specific installation.

(6) Confirm that the EOPs used for operator training will conform to the technical content of NRC approved EOP guidelines (generic or plant specific).