September 10, 1987

Docket No. 50-302

Mr. W. S. Wilgus
Vice President, Nuclear Operations
Florida Power Corpora' on
ATTN: Manager, Nuclear Licensing
P.O. Box 219
Crystal River, Florida 32629

DISTRIBUTION

Docket File	OGC-Bethesda
NRC PDR	E. Jordan
Local PDR	J. Partlow
PD22 Rdg.	ACRS (10)
S. Varga	Gray File
G. Lainas	H. Silver
D. Miller	H. Berkow

Dear Mr. Wilgus:

SUBJECT: TMI ACTION ITEM II.F.2 - CRYSTAL RIVER UNIT 3 (TAC NO. 45124)

The NRC staff has completed its review of the final design of the Crystal River Unit 3 Inadequate Core Cooling (ICC) system required by the Order for Modification of License dated December 10, 1982 covering Item II.F.2 of NUREG-0737. We have concluded that the design satisfies the requirements of NUREG-0737 and is acceptable. A safety evaluation is enclosed (Enclosure 1).

Please initiate the remaining actions necessary to implement the complete ICC system, and within 60 days of receipt of this letter, provide a schedule for completion of the remaining milestones in the standard set of milestones for implementation of the ICC system (Enclosure 2).

The reporting and/or recordkeeping requirements contained in this letter affect fewer than 10 respondents; therefore, OMB clearance is not required under P.L. 96-511.

Sincerely,

Harley Silver, Project Manager
Project Directorate II-2
Division of Reactor Projects-I/II

Enclosures: As stated

cc w/enclosures:
See next page

LA:PDII-2	PM:PDII-2	D:PDII-2
DMiller	HSilver:bg	HBerkow
9/10/87	9/10/87	9/ /87

8709250256 870910
PDR ADOCK 05000302
P PDR

The SMMs were tested for and meet the requirements for seismic and environmental qualification. The redundant channels are powered from separate Class 1E power sources. Suitable buffering is provided between the plant instrumentation sensors and the SMM channels. Each SMM is capable of being manually switched to either coolant loop to improve overall availability.

2.2 Core Exit Thermocouple (CET) System

The core exit thermocouple system consists of a total of 52 CETs distributed throughout the core. The primary operator display is provided by a core map diagram on the plant computer monitor. The temperature at each of the 51 CET locations is displayed and bad readings are identified. The highest temperature of all operable CETs is highlighted in color and is updated continuously when the core map is displayed. A hard copy of the core map is printed on demand by the computer line printer. The operable display range is 0°F to 2,500°F. The computer provides a capability to display or print a temperature-time digital trend history for any CET, singly or in groups, by operator selection. In addition, four analog strip chart recorders are driven by the computer and each can provide a trend record of any CET. Any CET exceeding 700°F will be alarmed on a dedicated alarm monitor and printer and the alarmed points will be indicated in color on the core map.

The CET backup display consists of three multi-pen analog temperature recorders located 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 have alarm capability, can automatically change chart speed on alarm, and will detect inoperable CETs.

In addition, each SMM channel can display on demand the hottest CET selected from a group of six CETs. A total of 12 CETs have been selected to provide representative temperatures from each core quadrant and the control region. These instruments display temperature over a range of 0°F to 1,023°F.

The primary and backup display channels are electrically independent, energized from independent power sources, and physically separated in accordance with Regulatory Guide 1.75 up to and including the isolators. The primary display and computers are not Class 1E. All CETs connected to both safety and nonsafety systems are isolated prior to the connection with nonsafety systems. CETs connected only to the plant computer (nonsafety) are not isolated. The incore probe assemblies and all cables and connectors associated with the CET system have been replaced with qualified units.

2.3 Reactor Coolant Inventory Tracking System (RCITS)

The reactor coolant inventory tracking system uses differential pressure (DP) measurements across vertical elevations of the hot leg and the reactor vessel to infer coolant level when the reactor coolant pumps are tripped. The wide range measurements are from the top of each hot leg (candy cane) to the bottom of the hot legs. The narrow range measurements are from the top of the reactor vessel head to the bottom of the hot legs. The total of four DP transmitters are paired for redundancy with one wide range and one narrow range transmitter in each channel. The channels are independently powered by Class 1E instrumentation power. The transmitters are located inside containment and seal chambers are located at the high point of each reference leg to keep the legs full of water. The lower pressure taps are located on a common decay heat suction line. Physical precautions have been taken to minimize the vulnerability of the single lower connection. Density compensation is employed to correct for temperature effects on the reference leg and process liquid density. A section of the tubing between the vessel top tap and the refueling cavity wall is removable for refueling. Removable seismic supports are provided. The DP transmitters are Class 1E and qualified for the containment environment.

The narrow range transmitters are calibrated for approximately 12 feet of water which, when compensated for system temperature variations, will be equivalent to the level of the coolant in the reactor vessel, above the bottom of the hot leg, when the RCPs are tripped. The wide range transmitters are calibrated for approximately 50 feet of water, which is equivalent to the level of coolant within the hot leg when the RCPs are tripped. The DP measurements are not functional when the RCPs are running or during venting operations. RTDs on the vertical portions of the reference legs and in the hot legs provide the temperature measurements for appropriate compensation of level indications.

Two independently-powered electronic analog equipment racks are used to power the DP transmitters and process the outputs to compute coolant level. The output signals are sent to analog indicators located on a panel in the control room and isolated signals are supplied to the plant computer. The coolant level indicators will read off-scale high when the RCPs are running and operational procedures will instruct the operators that the level indications are invalid under these conditions.

An error analysis of the system predicts measurement uncertainty of +/- 3.26% for the plant in normal conditions. For the accident case this uncertainty is +/- 7.84%, taking into account the system errors under accident conditions. Additional uncertainty may arise during inadequate core cooling conditions due to turbulence in the reactor coolant system. This error cannot be calculated and there are no tests to provide validity, but is expected to be in the order of 10 to 20%.

The RCITS is installed and has been functionally tested and calibrated.

2.4 Reactor Coolant Pump Void Trend Monitoring (RCPVTM) System

The RCPVTM system provides a monitor of reactor coolant inventory with the RCPs running by measuring RCP motor current to infer the density of the pumped fluid. The system uses pump inlet temperature in an algorithm with the pump current measurements to derive an estimate of the pumped fluid void fraction. Existing current transformers (non-Class 1E) and RTDs (one each per pump) are used to provide pump current and pump inlet temperature signals to a computer. The computer calculates the corresponding saturated liquid and vapor densities for each temperature input and combines the densities with the pump current in accordance with the void fraction algorithm. Analog indicators in the control room provide indication of the void fraction for any single pump, or the average void fraction for all pumps running, over a range of 15 to 40 percent void fraction. The indicators are located in close proximity with the RCITS indicators.

3.0 CONCLUSION

The staff has reviewed the final design of the Crystal River Unit 3 ICC monitoring system and finds it to be acceptable. The system design features, including qualification, redundancy, display, location, response accuracy, etc., all satisfy the requirements of the NUREG-0737.

4.0 REFERENCES

1. Letter from USNRC to FPC, D. G. Eisenhut to J. A. Hancock, dated December 10, 1982.

2. Letter from FPC to USNRC, 3F-0483-11, G. R. Westafer to H. R. Denton, dated April 15, 1983.

3. Letter from FPC to USNRC, 3F-0483-19, G. R. Westafer to H. R. Denton, dated April 25, 1983.

4. Letter from FPC to USNRC, 3F-0783-15, G. R. Westafer to H. R. Denton, dated July 18, 1983.

5. Letter from FPC to USNRC, 3F-1083-09, E. C. Simpson to J. F. Stolz, dated October 7, 1983.

6. Letter from FPC to USNRC, 3F-0284-07, G. R. Westafer to J. F. Stolz, dated February 15, 1984.

7. Letter from FPC to USNRC, 3F-0884-16, G. R. Westafer to J. F. Stolz, dated August 31, 1984.

8. Letter from FPC to USNRC, 3F-0285-01, G. R. Westafer to J. F. Stolz, dated February 1, 1985.

9. FPC, Specifications for Electric Transmitter SP-5061 R2, dated February 13, 1984.

10. Letter from FPC to USNRC, 3F-1085-12, G. R. Westafer to J. F. Stolz, dated October 23, 1985.

11. Letter from FPC to USNRC, 3F-1186-23, E. C. Simpson to J. F. Stolz, dated November 24, 1986.

12. FPC Calculations - ICC 14235.13-K-02 Rev. 2, dated November 28, 1986.

13. Letter from J. L. Anderson (ORNL) to G. A. Schwenk (NRC) dated June 15, 1987.

Dated: September 10, 1987

Principal Contributor:

G. Schwenk

ENCLOSURE 2

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. Reactor Coolant Inventory Tracking Systems (RCITS) 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 guideline (by licensee).

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

* 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).

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 license).

- System Fully Operational -

September 10, 1987

Docket No. 50-302

Mr. W. S. Wilgus
Vice President, Nuclear Operations
Florida Power Corporation
ATTN: Manager, Nuclear Licensing
P.O. Box 219
Crystal River, Florida 32629

DISTRIBUTION	
Docket File	OGC-Bethesda
NRC PDR	E. Jordan
Local PDR	J. Partlow
PD22 Rdg.	ACRS (10)
S. Varga	Gray File
G. Lainas	H. Silver
D. Miller	H. Berkow

Dear Mr. Wilgus:

SUBJECT: TMI ACTION ITEM II.F.2 - CRYSTAL RIVER UNIT 3 (TAC NO. 45124)

The NRC staff has completed its review of the final design of the Crystal River Unit 3 Inadequate Core Cooling (ICC) system required by the Order for Modification of License dated December 10, 1982 covering Item II.F.2 of NUREG-0737. We have concluded that the design satisfies the requirements of NUREG-0737 and is acceptable. A safety evaluation is enclosed (Enclosure 1).

Please initiate the remaining actions necessary to implement the complete ICC system, and within 60 days of receipt of this letter, provide a schedule for completion of the remaining milestones in the standard set of milestones for implementation of the ICC system (Enclosure 2).

The reporting and/or recordkeeping requirements contained in this letter affect fewer than 10 respondents; therefore, OMB clearance is not required under P.L. 96-511.

Sincerely,

Harley Silver, Project Manager
Project Directorate II-2
Division of Reactor Projects-I/II

Enclosures: As stated

cc w/enclosures:
See next page

LA:PDII-2	PM:PDII-2	D:PDII-2
DMiller	HSilver:bg	HBerkow
9/10/87	9/10/87	9/10/87

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 license).

- System Fully Operational -