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Docket Nos. 50-250
and 50-251

JUL 27 1983

Dr. Robert E. Uhrig, Vice President
Advanced Systems and Technology
Florida Power and Light Company
Post Office Box 14000
Juno Beach, Florida 33408

Dear Dr. Uhrig:

SUBJECT: GENERIC LETTER 81-21 "NATURAL CIRCULATION COOLDOWN," DATED MAY 5, 1981

By Generic Letter 81-21 dated May 5, 1981, we requested that Florida Power and Light Company (FP&L) provide an assessment of Turkey Point Units 3 and 4 procedures and training program to properly control a natural Circulation Cooldown event. The assessment was to include assurance that reactor vessel voiding would not occur; adequate condensate grade auxiliary feed water would be available; a description of your training program and any revisions to the procedures resulting from the assessment.

We have reviewed your response dated December 4, 1981, which addressed the above concern. The enclosed Safety Evaluation provides the results of our review. We have noted in our conclusions that the FP&L procedures will be acceptable upon implementation of the NRC - approved Westinghouse Owners Group Emergency Response Guidelines. In addition, we requested you confirm that your training program addresses how voids occur, the safety significance signs that indicated voiding is occurring and procedures to prevent and mitigate voiding. Subsequent to our Safety Evaluation, we have discussed the FP&L training program with your staff and have determined that the training program adequately addresses the items identified above.

We have concluded, based on our evaluation that natural circulation cooldown for Turkey Point Units 3 and 4 has been adequately addressed and your response to Generic Letter 81-21 is acceptable.

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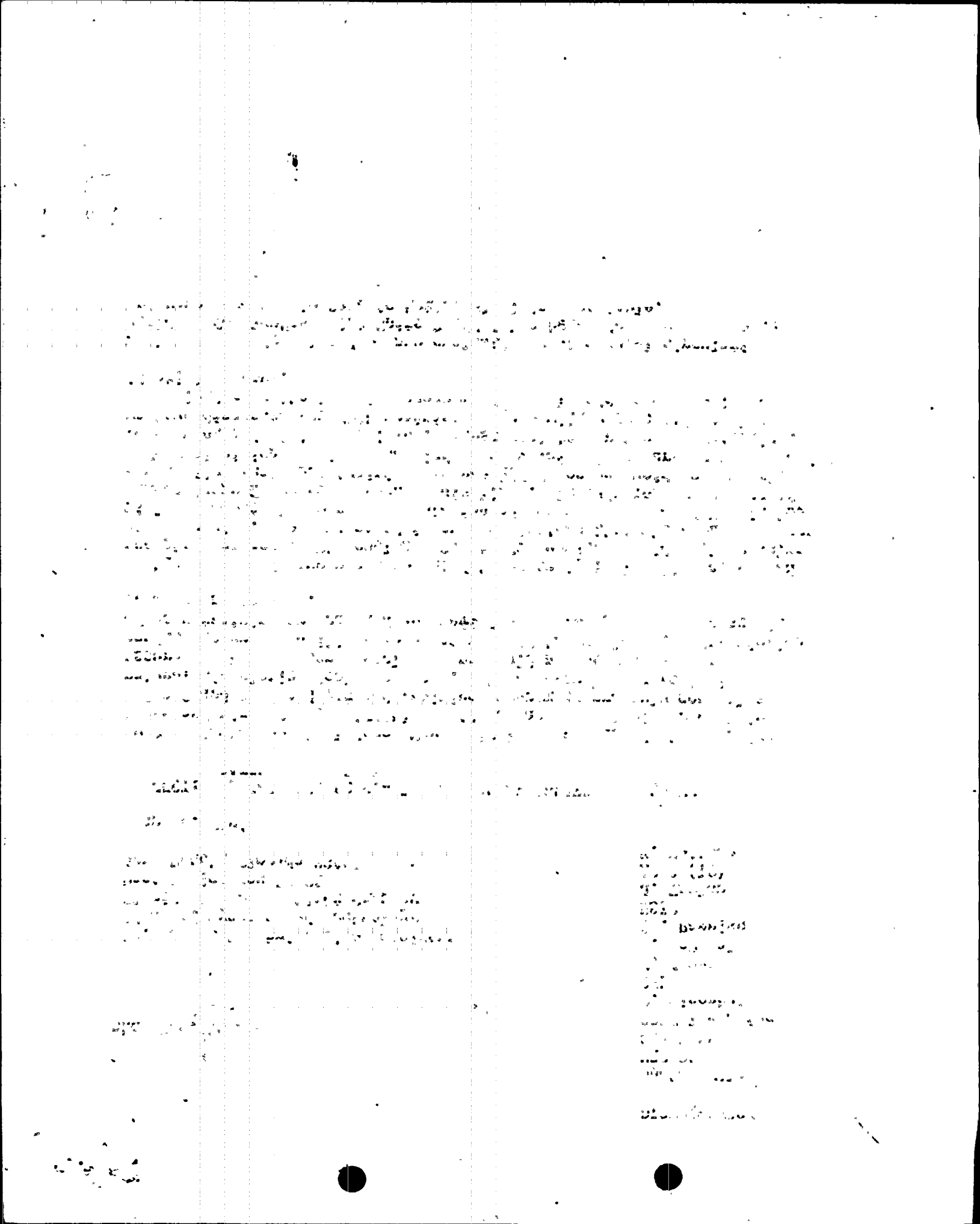

JUL 27 1983

This letter affects fewer than ten respondents, therefore OMB clearence is not required under P. L. 96-511.

Sincerely,

Original signed by:
S. A. Varga

Steven A. Varga
Operating Reactors Branch No. 1
Division of Licensing

Enclosure:
As stated

cc w/enclosure:
See next page

OFFICE	ORB#1	ORB# 3	ORB# 1				
SURNAME	DMcDonald/pb	KHeitner	SVarga				
DATE	7/22/83	7/21/83	7/27/83				

Safety Evaluation

Turkey Point Units 3 and 4 Regarding Generic Letter 81-21,

Natural Circulation Cooldown

Background - On June 11, 1980, St. Lucie Unit 1 experienced a natural circulation cooldown event which resulted in the formation of a steam bubble in the upper head region of the reactor vessel. This resulted in the generation of an NRC Generic Letter dated May 5, 1981 to all PWR licensees. The licensees were to provide an assessment of the ability of their facility's procedures and training program to properly manage similar events. This assessment was to include:

(1) A demonstration (e.g., analysis and/or test) that controlled natural circulation cooldown from operating conditions to cold shutdown conditions conducted in accordance with their procedures, should not result in reactor vessel voiding.

(2) Verification that supplies of condensate grade auxiliary feedwater are sufficient to support their cooldown method, and

(3) A description of their training program and the revisions to their procedures.

The licensee responded to this request in the reference 2 letter. The following is our evaluation of the licensee's response to the concerns outlined above.

Evaluation .- In its submittal, the licensee refers to a Westinghouse study that evaluates the potential for steam formation in Westinghouse NSSS's and recommends modifications to the operator guidelines. The results of the Westinghouse report W-OG-57 (Reference 3), are applicable to all 2, 3, and 4 loop plants. The report concludes that in previous analyses for operating guidelines and safety analyses, void formation in the upper head is explicitly accounted for if it is calculated to occur. These previous analyses indicate that voiding is not a safety concern because the voids will collapse when they come in contact with the subcooled region of the vessel.

The present analyses differentiate between T_{hot} and T_{cold} plants. T_{cold} plants are those which have sufficient flow between the downcomer and the upper head such that the temperature of the upper head is approximately the same as the cold leg temperature. T_{hot} plants have an upper head temperature between the hot leg and cold leg temperature. This SER will deal with the T_{hot} analyses because the Turkey Point units are considered to be T_{hot} plants.

The analysis is done using the WFLASH code. The WFLASH code has 2-phase capability and can track void propagation. The analysis assumes a best estimate model and an inverted top hat upper support plate design. The initial upper head temperature is conservatively set equal to the hot leg temperature. Metal heat addition to the upper head area from the vessel and internals is taken into account. It is assumed that the reactor coolant pumps are stopped at the beginning of the transient.

The analysis is done for two cooldown rates, 25°F/hr and 50°F/hr. An analysis is also done which accounts for the effect of the Control Rod Drive Mechanism (CRDM) cooling fans. These fans blow air across the vessel head and provide some additional cooling of the upper head.

One of the conditions that must be met during a cooldown is that the primary system pressure be 400 psia when the primary system temperature is 350°F. These are conditions which would permit the Residual Heat Removal System (RHRS) to be used. The analyses show that when the CRDM fan cooling effect is not included, neither cooldown rate can meet this condition without upper head voiding unless the depressurization is halted when the primary temperature reaches 350°F and the upper head is given time to cool off. A hand calculation shows this cool-off period is approximately 20 hours for a 25°F/hr cooldown rate and is approximately 27 hours for a 50°F/hr cooldown rate.

An additional analysis includes the effect of the CRDM cooling fans and results in a significant increase in the rate of cooldown of the upper head. The CRDM cooling fans provide cooling of the CRDM magnetic jack coil winding. The system consists of axial fans that pull containment air past the coil housings and across the Reactor Vessel Head. The analysis was based on a hand calculation. This calculation assumed that the CRDM fan cooling system removes 780KW at full power. This energy removal is equal to an upper head cooldown rate of 32°F/hr when the upper head temperature is 600°F. Assuming that the cooldown rate is proportional to the temperature difference between the upper head metal

and the containment atmosphere, the CRDM fans would cool the upper head at a rate of 17°F/hr when the upper head fluid is 350°F.

Based on these analyses the Westinghouse report makes the following conclusions and recommendations for operator guidelines:

1. If the CRDM cooling effect is included the operator can reach shutdown cooling entry conditions without void formation if a 25°F/hr cooldown rate is used. The operator should maintain 50°F subcooling in the system.
2. If the CRDM fans are not available, the operator should commence a 25°F/hr cooldown and should depressurize at a rate which maintains 50°F subcooling until the system reaches 1900 psi. At this point the depressurization rate should be changed so that a 200°F subcooling margin is maintained until the system reaches 1200 psi. At this time the depressurization should be stopped. When the primary temperature reaches 350°F, a 20-hour cool-off period should be allowed before depressurization.

The licensee states that a sensitivity study was performed to ensure this generic analysis is applicable to Turkey Point. The CRDM cooling system is not safety related and the heat removal capacity of the system at Turkey Point may differ from that used in the analysis. The recommendations for a natural circulation cooldown procedure with the CRDM fans running were investigated and found to be acceptable for both Turkey Point units. The licensee concludes that following a loss

of offsite power, the plant can safely cooldown to cold shutdown because the CRDM fans can be manually loaded on to the diesel.

The procedure that will be implemented at Turkey Point instructs the operator to cooldown at 25°F/hr to 350°F. The system is gradually depressurized while maintaining a 50° subcooling margin. This process will take approximately 9½ hours and 135,000 gallons of condensate. The licensee's condensate storage tank has a capacity of 250,000 gallons and a technical specification limit of 185,000 gallons. 185,000 gallons will remove sensible and decay heat for 19 hours. The licensee concludes that they have sufficient condensate supply for a natural circulation cooldown without void formation assuming the availability of the CRDM fans.

The licensee stated in reference 2 that natural circulation cooldown has been included in its training program. The program includes the results of the Westinghouse analysis and the revisions made to their procedures. The staff believes that the licensee's training program should include discussions on how voiding occurs, the safety significance of the consequences of voiding, the St. Lucie event, and a discussion of applicable procedures. The licensee only specifies that the final item is addressed and should review its training program to ensure that all items are addressed. The staff emphasizes the importance of training and procedures in resolving this issue. The review of generic guidelines was part of TMI Action Item I.C.1, Generic Review of Vendor Guidelines. The Westinghouse Owners Group Emergency Response Guidelines include ES-0.2, Natural Circulation Cooldown. This guideline incorporates the

results of the analyses previously discussed. These guidelines were reviewed and approved by the NRC staff. The staff concludes that if the licensee appropriately implements the generic emergency guidelines into their plant-specific procedures, adequate procedures will be available for the operator to safely conduct a controlled natural circulation cooldown even should limited upper head voiding occur.

Conclusion

Upper head voiding, in itself, does not present any safety concerns provided that the operator has adequate training and procedures to recognize and react to the situation. Voiding in the upper head makes RCS pressure control more difficult and therefore, it the situation warrants, natural circulation cooldown should be done without voiding. This SER did not attempt a review of guidelines. The effort is being conducted under TMI Action Item I.C.1, Generic Review of Vendor Guidelines. The staff finds that upon acceptable implementation of the NRC-approved Westinghouse Owners Group Emergency Response Guidelines, the licensee's procedures will be adequate to perform a safe natural circulation cooldown. The licensee is requested to review its training program and confirm that the following items have been addressed:

a) how voiding occurs and the safety significance of its consequences
b) signs that voiding is occurring
c) discussion of procedures to prevent and mitigate voiding

References

1. Generic Letter 81-21, "Natural Circulation Cooldown," May 5, 1981.

2. Letter, Uhrig to Eisenhut "Turkey Point Unit 3 and 4, Natural Circulation Cooldown", December 4, 1981.

3. Letter w/enclosure, Jurgensen to Check, "St. Lucie Cooldown Event Report," W-OG-57, April 20, 1981.

4. NUREG-0611, "Generic Evaluation of Feedwater Transients and Small Break Loss-of-Coolant Accidents in Westinghouse Designed Operating Plants", January 1980.

Robert E. Uhrig
Florida Power and Light Company

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