March 18, 1985

Docket Nos. 50-259/260/296

MEMORANDUM FOR: Roger Walker, Director
Division of Reactor Projects
Region II

FROM: Hugh L. Thompson, Jr., Director
Division of Licensing
Office of Nuclear Reactor Regulation

SUBJECT: DEFICIENCIES IN BROWNS FERRY TECHNICAL SPECIFICATIONS FOR SINGLE LOOP OPERATION (SLO)

In a memorandum (Olshinski to Eisenhut) of December 26, 1984, Region II indicated concern that the Browns Ferry SLO Technical Specifications (TS) may be inadequate, and requested that amendments be imposed that adequately define acceptable operating limits. Specifically, it was noted that the Browns Ferry TS permit operation in the single loop mode for 24 hours (many other custom TS for operating BWRs also do so) whereas the BWR Standard TS limit SLO to 12 hours. It was also noted that we had issued an amendment for Peach Bottom Unit 3 for SLO with specified thermal hydraulic restrictions.

Single-loop operation for BWRs with respect to thermal-hydraulic stability has been under review as Multiplant Action item E-04 for a number of years. More recently, we have identified this as a generic issue embracing thermal-hydraulic stability for dual-loop, as well as single-loop operation and are pursuing it accordingly (see enclosure). In early 1984, based on new data, General Electric issued SIL-380, Revision 1 to BWR licenses providing additional operating recommendations to protect against potential instabilities involved in single and dual-loop operations. In addition, in response to our request, TVA conducted on February 9, 1985 single-loop stability tests at Browns Ferry Unit 1. The preliminary results from these tests considerably ameliorated our concerns related to instabilities.

We understand that TVA will modify its previous technical specification change request on single-loop operation and request an amendment utilizing the SIL recommendations and the Unit 1 test results. We expect that the

CONTACT:
P. Clark
49-27162

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changes will be similar to those we approved for Peach Bottom Unit 3 and Hatch, which incorporated specified thermal-hydraulic technical specification restrictions in accordance with the SIL.

Original signed by
Frank J. Miraglia

Hugh L. Thompson, Jr., Director
Division of Licensing
Office of Nuclear Reactor Regulation

Enclosure:
As stated

cc: All Regional Administrators

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

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MEMORANDUM FOR: Robert M. Bernero, Director
Division of Systems Integration

FROM: Harold R. Denton, Director
Office of Nuclear Reactor Regulation

SUBJECT: SCHEDULE FOR RESOLVING AND COMPLETING GENERIC ISSUE NO. B-19 - THERMAL-HYDRAULIC STABILITY

The technical resolution for Generic Issue B-19, "Thermal-Hydraulic Stability" is available. This memorandum approves NRR staff taking appropriate actions necessary to complete this issue. The evaluation of the subject issue is provided in Enclosure 1.

In accordance with NRR Office Letter No. 40, "Management of Proposed Generic Issues," the resolution of this issue will be monitored by the Generic Issue Management Control System (GIMCS). The information needed for this system is indicated on the enclosed GIMCS information sheet (Enclosure 2). Your schedule for resolving and completing this generic issue should be commensurate with the high priority nature of the work and consistent with the NRR Operating Plan. Normally, as stated in the Office Letter, the information needed should be provided within six weeks.

The enclosed prioritization evaluation will be incorporated into NUREG-0933, "Prioritization of Generic Safety Issues," and is being sent to other NRC offices, the ACRS, and the PDR for comments on the technical accuracy and completeness of the prioritization evaluation. Any changes as a result of comments will be coordinated with you. However, the schedule for the resolution of this issue should not be delayed to wait for these comments.

The information requested should be sent to the Safety Program Evaluation Branch, DST. Should you have any questions pertaining to the contents of this memorandum, please contact Louis Riani (24563).

Harold R. Denton, Director
Office of Nuclear Reactor Regulation

Enclosures:
1. Prioritization Evaluation
2. Generic Issue Management Control System

cc: See next page

[illegible]

cc w/o Enclosure 2:
V. Stello
J. Funches
R. Minogue, RES
R. DeYoung, IE
C. Heltemes, Jr., AEOD
J. Davis
F. Rowsome
W. Minners
ACRS
PDR

cc w/Enclosure 2:
R. Capra
C. Berlinger
L. Phillips
R. Emrit
L. Riani

ENCLOSURE 1

PRIORITIZATION EVALUATION

GENERIC ISSUE B-19

"THERMAL-HYDRAULIC STABILITY"

ISSUE NO. B-19: THERMAL - HYDRAULIC STABILITY

DESCRIPTION

Historical Background

The possibility of thermal-hydraulic instability in a BWR has been investigated by GE since the start-up of early BWRs (references 2, 3). Analytical methods and codes were formulated on the basis of these early investigations (references 7, 8, 9, 10, 11, 12, 13, and 15) with which to predict the stability characteristics of BWRs. Eventually the licensing basis and analytical methods used by the General Electric Company to evaluate the stability of BWRs were documented and presented in January 1977 in NEDO-21506 (reference 1). Since 1977, significant effort has been expended on developing an understanding of BWR instability. Testing at operating BWRs (references 4, 5, and 6) has added to the information obtained from single channel and control rod oscillator tests in the early BWRs (reference 3). In addition, improved state-of-the-art thermal-hydraulic methods and fuel rod performance studies have permitted greater definition of the stability phenomenon and criteria for prevention of instability (references 14, 17). Developments along these lines have resulted in updated methods and models for the assessment and evaluation of BWR stability limits for licensing purposes (references 18 and 19). However, recent data from a high-power-density foreign BWR unexpectedly indicated that scram protection based on the average power range monitor signals would not necessarily prevent violation of the critical heat flux limits if local instabilities occur. As a result of these findings the staff proposed the issuance of a Board Notification (reference 20).

At the request of the licensees the NRC staff has reviewed two submittals and has recently approved technical specification changes for two BWRs to resolve the concerns related to the thermal-hydraulic stability in these plants (references 21 and 22).

SAFETY SIGNIFICANCE

Hydrodynamic flow instabilities may occur in a BWR when two-phase flow exists in a channel with critical dimensions and particular flow parameters. The instability can cause power oscillations and lead to local violation of the critical heat flux.

POSSIBLE SOLUTIONS

The proposed resolution is Technical Specifications that will restrict operation of the reactor in regions of potential thermal-hydraulic instability and/or provide for surveillance and corrective measures under conditions of marginal stability.

CONCLUSION

Updated analytical methods and analyses based on the recent experimental results have been made available to address thermal-hydraulic instability concerns. These methods are being reviewed by the NRC staff to determine their acceptability for evaluating the stability of core designs and for delineating the power/flow regions of potential instability for which reactor operation will be restricted by appropriate modification of the plant technical specifications (references 21 and 22). Therefore, the resolution of this issue has been identified.

References:

1. "Stability and Dynamic Performance of the General Electric Boiling Water Reactor," General Electric Company, Licensing Topical Report, January 1977 (NEDO-21506).

2. R. T. Lahey, Jr., et al., "Control Rod Oscillator Tests - Garigliano Nuclear Reactor," General Electric Company, August 1967 (GEAP-5534).

3. R. O. Niemi, "Dresden-3 Rod Oscillator Tests," General Electric Company, 1973 (NEDM-13357).

4. L. A. Carmichael and R. O. Niemi, "Transient and Stability Tests at Peach Bottom Atomic Power Station Unit 2 End of Cycle 2," Electric Power Research Institute, 1978 (EPRI NP-564).

5. F. B. Woffinden and R. O. Niemi, "Low Flow Stability Tests at Peach Bottom Atomic Power Station Unit 2 During Cycle 3," Electric Power Research Institute, 1981 (EPRI NP-972).

6. S. F. Chen and R. O. Niemi, "Vermont Yankee Cycle 8 Stability and Recirculation Pump Trip Test Report," General Electric Company, March 1982 (NEDE-25445).

7. "General Electric BWR Thermal Analysis Basis (GETAB): Data, Correlation and Design Application," General Electric Company, Licensing Topical Report, January 1977 (NEDO-10958-A).

8. L. A. Carmichael and G. J. Scatena, "Stability and Dynamic Performance of the General Electric Boiling Water Reactor," General Electric Company, 1969 (APED-5652).

9. R. B. Linford, "Analytical Methods of Plant Transient Evaluations for the General Electric Boiling Water Reactor," General Electric Company, Licensing Topical Report, February 1973 (NEDO-10802).

10. C. L. Martin, "Lattice Physics Methods," General Electric Company, Licensing Topical Report, June 1976 (NEDO-20913).

11. J. A. Woolley, "Three-Dimensional BWR Core Simulator," General Electric Company, Licensing Topical Report, May 1976 (NEDO-20953).

12. C. L. Martin, "Lattice Physics Methods Verification," General Electric Company, Licensing Topical Report, May 1976 (NEDO-20939).

13. G. R. Parkos, "BWR Simulator Methods Verification," General Electric Company, Licensing Topical Report, May 1976 (NEDO-20946).

14. S. A. Akerlund, et al., "GESTR-LOCA: A Model for the Prediction of Fuel Rod Thermal Performance," General Electric Company, December 1981 (NEDE-23785-1-P, Rev. 1).

15. W. R. Morgan, "In-Core Neutron Monitoring System for General Electric Boiling Water Reactors," General Electric Company, April 1969 (APED-5706).

16. R. T. Lahey, Jr. and F. J. Moody, "The Thermal-Hydraulics of a Boiling Water Reactor," American Nuclear Society, Hinsdale, Ill. (1977).

17. J. W. Spore, "TRAC-BWR Completion Report: BWR Fuel Channel Model," EG&G Idaho, July 1980 [WR-CD-021 (CR-JA01)].

18. G. A. Watford, "Compliance of the General Electric Boiling Water Reactor Fuel Designs to Stability Licensing Criteria," GE Proprietary Information, December 1982.

19. "Stability Evaluation of Boiling Water Reactor Cores Sensitivity Analyses," Exxon Nuclear Co., Inc., XN-NF-691(P)(A) and Supplement 1, August 22, 1984.

20. Memorandum from R. J. Mattson to D. G. Eisenhut, "Board Notification - BWR Core Thermal Hydraulic Stability," February 27, 1984.

21. Memorandum for L. S. Rubenstein to T. M. Novak, "Susquehanna 1 and 2 - Thermal Hydraulic Stability Technical Specification Change (TACS 55021 and 55022)," July 11, 1984.

22. Memorandum from L. S. Rubenstein to G. C. Lainas, "SER Input for Peach Bottom-3 Technical Specification Changes for Cycle 6 Operation with Increased Flows and Decreased Feedwater Temperatures (TACS #55123)," October 23, 1984.