PUBLIC SERVICE ELECTRIC AND GAS COMPANY
HOPE CREEK PROJECT

SAFETY EVALUATION

No. PSE-SE-Z-004

TITLE: SUBSTITUTION OF TECHNICAL SPECIFICATION SURVEILLANCE FOR CORE PERFORMANCE TESTING - TEST NUMBER 17 OF THE POWER ASCENSION TEST PROGRAM

Date: AUG 20 1985

1.0 PURPOSE

The purpose of this Safety Evaluation is to determine the acceptability of substituting the Plant Technical Specification Surveillance Procedures for the Core Performance testing during the Power Ascension Program.

2.0 SCOPE

The test specifications are related to the Nuclear Core which is a subsystem of the Nuclear Boiler.

3.0 REFERENCES

1. General Electric Startup Test Specification, 23A4137, Revision 0
2. Regulatory Guide 1.68, Revision 2, August 1978
3. Hope Creek Generating Station Final Safety Analysis Report
4. Hope Creek Generating Station Draft Technical Specifications

4.0 DISCUSSION

Regulatory Guide 1.68 (Revision 2, August 1978), Appendix A, paragraph 5.b requires that steady-state core performance to be in accordance with design throughout the permissable range of power-to-flow conditions. Test Number 17, Core Performance (FSAR Figure 14.2-5), evaluates the principal thermal and hydraulic parameters associated with core behavior. These parameters include the core thermal power and flow and thermal margins. Testing is performed at Test Conditions 1, 2, 3, 4, 5, and 6 of FSAR Figure 14.2-4). It is proposed that the Plant Technical Specification Surveillance Procedures, associated with compliance to required thermal margins, be substituted for Test Number 17.

The Plant Technical Specifications define the monitoring requirements for demonstration of compliance with thermal margins (Maximum Linear Heat Generation Rate, MLHGR, Minimum Critical Power Ratio, MCPR, and Maximum Average Planar Linear Heat Generation Ratio, MAPLHGR). The applicable Technical Specification sections (Sections 3/4.2.4, 3/4.2.3, 3/4.2.1) require that at least once per 24 hours the thermal margins are verified to be within the specified limits when core thermal power is greater than or equal to 25% of rated thermal power. In addition, within 12 hours after a thermal power increase of at least 15% of rated thermal power, the thermal limits must also be verified. Complying with these Technical Specification Surveillance requirements meets the objectives of Regulatory Guide 1.68 (Revision 2, August 1978), Appendix A, paragraph 5.b and Test Number 17.

Plant Surveillance Test procedures in accordance with Technical Specifications are also utilized to calibrate the Local Power Range Monitors (LPRMs) and Average Power Range Monitors (APRMs). Together, these two plant surveillance procedures ensure that the APRM instrumentation is correctly measuring core thermal power and the demonstration of compliance to rated power is required by the plant operating license.

Test Number 11, Process Computer, verifies the performance of the process computer under plant operating conditions. As part of this verification, manual or off-line calculations are used to evaluate the process computer calculations for MCPR, MLHGR, and MAPLHGR. In addition, manual heat balance calculations are performed to verify the accuracy of the process computer power calculation. This test, therefore, provides assurance that the process computer calculations for core thermal power and thermal margins are consistent with design methods.

To provide assurance that the core flow measurement system is functioning properly, two specific tests are dedicated to the calibration and measurement of core flow parameters. Test Number 29, Recirculation System Flow Calibration, provides a complete calibration of the installed recirculation flow instrumentation including specific signals to the plant process computer. The core

flow is measured by summing the flow from the individual jet pumps. The jet pump flows are determined from single and double tap pressure differential instruments. Recirculation drive flow, which is an input to rod block and scram setpoints, is determined from an elbow tap differential presure. The calibration of the instrumentation is performed at Test Condition 3 and Test Condition 6 of FSAR Figure 14.2-4 to ensure that the system will provide a correct core flow indication at rated conditions. Test Number 28C, Recirculation System Performance, records recirculation system parameters during the power test program (Test Conditions 2, 3, 4 and 6). Core flow (from jet pump flow instrumentation), core pressure drop, jet pump M-ratio, drive flow and recirculation pump efficiency are evaluated and compared to predicted values. The flow control system is also adjusted at this time to limit the maximum core flow to 102.5% of rated. These tests therefore, provide adequate assurance that the core flow is being measured properly.

5.0 CONCLUSION

Compliance with the Plant Technical Specification Surveillance Requirements and performance of the system tests noted above will satisfy the objectives of Regulatory Guide 1.68 (Revision 2, August 1979), Appendix A, paragraph 5.b, as well as the requirements of Startup Test Number 17. Based on the above discussion, the proposed change will not affect any safety systems or the safe operation of the plant and therefore does not involve an Unreviewed Safety Question, the proposed changes do not affect the safe operation of the plant and revisions to the plant Technical Specifications are not required. Based on the above, the Plant Technical Specification Surveillance Procedures can be substituted for Startup Test Number 17.

6.0 DOCUMENTS GENERATED

NONE

7.0 RECOMMENDATIONS

Revisions to the Hope Creek Generating Station FSAR and Startup Test Procedures shall be made to reflect the substitution of the Plant Technical Specification Surveillance Requirements for the Core Performance Startup Program Test.

8.0 ATTACHMENTS

NONE

9.0 SIGNATURES

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Date

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TEST NUMBER 19 - CORE POWER-VOID MODE RESPONSE
JUSTIFY TEST DELETION

OBJECTIVE:

There are no specific Regulatory Guide 1.68 requirements to perform stability testing during the power ascension program. However, paragraphs 5.s, 5.v, and 5.h.h require the demonstration of acceptable control system responses during steady state and transient conditions. Test Number 19 (FSAR Figure 14.2-5), Core Power-Void Mode Response, measures the stability of the core power void dynamic response by moving a very high worth control rod one or two notches. In conjunction, Test Number 20, Pressure Regulator, performs pressure regulator step changes to measure the core power void dynamic response. These tests are currently planned to be performed at Test Conditions 4 and 5. It is proposed to delete the control rod movement tests as Test Conditions 4 and 5 (FSAR Figure 14.2-4), while still maintaining the pressure regulator testing at Test Condition 5.

DISCUSSION:

Response of the core power void mode is determined by analyzing test data and comparing to an acceptance criterion which defines the required system performance. The criterion required that all system related variables must exhibit non-divergent behavior. System related variables are heat flux and reactor pressure.

Extensive special testing of stability characteristics has been performed at several BWRs, including BWR/4 plants similar to Hope Creek (Peach Bottom-2 and Browns Ferry). The test data has demonstrated the stability characteristics of BWRs over a wide range of conditions and has been reviewed along with extensive supporting analyses, as part of the staff's Safety Evaluation Report on core thermal-hydraulic stability (Reference 4).

For modern high power density reactors, control rod oscillator tests are not desirable because of poor signal to-noice ratios in large reactor cores. Measurement of system stability will be provided using the small pressure perturbation techniques. This has been verified a reliable technique to determine the reactor core stability margins. Test Number 20, Pressure Regulator testing, measures the system response to pressure disturbances caused by actions of the pressure regulator system. This testing yields valuable core stability data at the limiting high power/low flow condition encountered during normal operation (Test Condition 5). In addition to Test Number 20, normal observations of operational power maneuvers provide sufficient data to

determine the normal stability characteristics and response of the system.

In addition to the pressure regulator testing, Service Information Letter (SIL) 380 (Reference 2) provides detailed recommendations for the monitoring of system behavior. These recommendations which are being incorporated by Hope Creek Generating Station, provide for monitoring of neutron flux characteristics during normal operation at high power low flow conditions and during abnormal operating conditions. In addition to the monitoring requirements, current Technical Specifications do not allow continued operation at natural circulation flow which is the least stable condition of the operating region.

CONCLUSION:

As a result of the extensive testing and analysis of core thermal-hydraulic stability, it has been demonstrated that General Electric BWR fuel and core designs meet the stability criteria set forth in General Design Criteria 10 and 12 of 10CFR50, Appendix A. Based on the above discussion and the Staff's Safety Evaluation Report (Reference 1), the proposed change will not affect any safety related systems or safe operation of the plant and therefore does not involve an unreviewed safety question. System stability is adequately measured during Test Number 20, Pressure Regulator, and has been extensively tested at several BWRs covering a wide range of designs. In addition, information on the system's stability is continuously provided by SIL-380 recommendations for the monitoring of neutron flux. Therefore, Test Number 19, Core Power-Void Mode Response can be deleted from the Power Ascension Test Program.

REFERENCES:

1. Letter, C.O. Thomas (NRC) to H.C. Pfefferlen (GE), "Acceptance For Referencing of Licensing Topical Report NEDE-24011, Rev. 6, Amendment 8, 'Thermal Hydraulic Stability Amendment to GETAR II'", April 24, 1985.

2. "BWR Core Thermal Hydraulic Stability", Service Information Letter 380, Revision 1, General Electric Company, February 10, 1984.

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