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U. S. Nuclear Regulatory Commission
Washington DC 20555

Attention: Theodore R. Quay, Director
Standardization Project Directorate

Subject: **SBWR - CLOSURE OF THE VACUUM BREAKER TEST PROGRAM**

Reference: 1. Letter, T. R. Quay (NRC) to J. E. Quinn (GE), Same Subject, dated February 14, 1996.

We have received the Reference letter acknowledging the active role NRC played during the testing program, the competent and experienced test personnel who conducted the tests, and the thoroughness of the test program. We are pleased with the NRC conclusion that the staff believes that the test results are valid and acceptable for licensing. With that confirmation we believe that the SBWR Vacuum Testing task is complete until the production valve is manufactured and tested as discussed below.

Leakage between the backside of the seal and the disk

This leakage was discovered during initial seal testing. As an expedient solution to prevent this leakage and continue the tests, RTV was used to seal the gap between the disk retaining groove and the seal. After application of the sealant, the primary dynamic seal was found to be bubble tight. RTV is widely used in nuclear applications and has been qualified elsewhere for environmental conditions equivalent to this application. The radiation and thermal aging of the seals with the RTV was not repeated because the preferred solution is to add a static seal to the back of the production valve main seal. The design of a static seal is relatively simple compared to a dynamic seal. The performance of the static seal will be verified during production valve acceptance tests. The addition of a static seal to the backside of the primary seal will have no affect on the validity of the prototype test program.

Compression set of the main seal caused by design basis steam testing

The wires placed under the vacuum breaker seat to simulate debris interferance following thermal/radiation aging, design basis accident testing, and reliability testing, demonstrated that the seal had taken a permanent set nearly flush with the hard seat. This resulted in a reduction of

main seal effectiveness if a particle was lodged on the hard seat. The preferred solution is a simple modification to the production valve seal to add a bead to the existing seal to resist compression set. This will ensure that sealing can be maintained if a particle lodges on the valve seat. The resistance of the production valve seal to compression set will be confirmed by thermal aging under compression loading. The addition of a properly designed bead to the seal will have no affect on the validity of the prototype test program.

Vacuum breaker flow capacity

A series of flow capacity tests were performed and are summarized in the figure on page 34 of: "SBWR Vacuum Breaker (VB) Prototype Experimental Qualification General Test Report ED45913" (MFN 155-94 dated 12/15/94). As shown on that figure, the stroke of the valve was not sufficient to meet the design flow capacity equivalent to 1.04 square feet. The stroke of the valve was then increased to establish that increasing the stroke would provide the required increase in flow capacity. Increasing the stoke by 40 mm increased the flow capacity by thirty percent to an equivalent of 1.0 square feet. This test established that stroke was limiting flow capacity and flow could be adjusted by varying stroke length to meet or exceed flow requirements considering the slightly reduced effective stroke with the chatter damper in place. The production valve will have adequate stroke and be tested to demonstrate the design flow requirement.

Design Basis Accident conditions

The design basis accident conditions were achieved in accordance with the requirements of IEEE 323. The term "fully degraded" means that the primary seal was thermally and radiation aged in accordance with IEEE 323 before being functionally tested for steam leak tightness as required by IEEE 323. This is described in the valve test specification 25A5445 (MFN 065-94 dated 5/2/94). Over the eighty hours of testing in a steam pressure vessel there was no measurable steam leakage through the valve. (Refer to Page 229 of ED 45913 for Design Basis Accident test report.)

Dynamic loads which result in lift of the disk

The valve was dynamically aged in accordance with IEEE 323 as described in Attachment E Page 88 of ED 45913. The test response spectra used for aging was an envelope of the SBWR SSE spectra at the elevation of the drywell floor where the valve is mounted. Following seismic aging, a fragility test of the valve was conducted up to the capability of the shake table. Movement of the valve disk was monitored by measuring changes in pressure across the disk. It was noted that at approximately 1G ZPA, deviations in pressure across the disk were observed.

Refer to paragraph 3.4.2 of, "SBWR Vacuum Breaker Prototype Experimental Qualification General Test Notification Plan" ED 45841 (MFN 155-94 dated 12/15/94) for a discussion of disk lift measurements. Disk lift occurred at acceleration levels well in excess of those predicted for the SBWR SSE.

Opening and closing reliability

The basis for the 3,000 cycle test is contained in report titled: "Bayesian Approach to the SBWR Vacuum Breaker Reliability Demonstration Testing" ECN-CX-93-135 provided to the NRC as part of a RAI 900.62 response (MFN 065-94 dated 5/2/94).

Sincerely,

James E. Quinn,
Projects Manager

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