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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

VERMONT YANKEE NUCLEAR POWER STATION

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BWR FEEDWATER AND CRD RETURN LINE MODIFICATIONS

1.0 Introduction

NUREG-0619 summarizes the work performed by the NRC staff to resolve Generic Activity A-10, "The cracking of feedwater and CRD return line nozzles." The triple-sleeve sparger configuration recommended by General Electric (GE) is different from previous designs. It protects the feedwater nozzle against the high frequency thermal cycles which are responsible for postulated crack initiation and growth mechanism in nozzles. The removal of cladding results in about a factor of two reduction in cyclic thermal stress at the surface of the metal. It also facilitates interpretation of UT signals by eliminating the interface between the cladding and the metal.

Guidance of NUREG-0619 recommends that the performance of the triple-sleeve sparger be monitored for leakage. Based on a conservative evaluation of test results, a minimal rate of leakage (of about one gallon per minute or less) will limit the initiation of cracks and crack growth rates to below ASME allowable depths during the life of the plant.

In addition to the triple-sleeve sparger, GE recommends some system and procedural changes regarding the control rod drive (CRD) return line nozzles. The recommended system modification involves rerouting the discharge of the Reactor Water Cleanup (RWCU) to deliver the flow to each feedwater nozzle. Although NEDE-21821-02 shows that system changes in general do not make a large contribution to delaying crack initiation, it does show that rerouting the RWCU can decrease the usage factor with respect to crack initiation from 0.70 to 0.46. This represents a significant usage factor reduction in those plants where rerouting of the RWCU is feasible.

2.0 Evaluation

The new spargers were installed without clad removal, however dye penetrant inspection of the nozzles revealed no cracks. Interference-fit thermal sleeve spargers were installed in the Vermont Yankee Nuclear Power Station in 1976. Although the new improved design spargers were not the triple-sleeve sparger configuration subsequently recommended by GE, the improved design should reduce the thermal cycling and lower the probability of crack initiation and lower the rate of crack growth. The licensee in a letter dated January 25, 1982 advised the staff that a thermal sleeve Bypass Leak Detection System was installed during the 1981 refueling outage. Criteria

for detecting deleterious leakage using the Bypass Leak Detection System were specified by the staff in a letter to the licensee dated August 10, 1982. Based on the licensee's commitment to use the Bypass Leak Detection System to detect any deleterious leakage, the staff concludes that any deleterious leakage will be detected in time.

The CRD return line nozzles were dye-penetrant tested and all return lines were rerouted to RWCU system in 1979. The rerouted line is valved open. The Vermont Yankee licensee is committed to an inspection of the CRD to RWCU tee-joint.

The licensee states that the original low flow (10% capacity) valve and controller were replaced with a drag type valve having improved flow characteristics and a single element water level control system with both manual and automatic control characteristics. System operation was examined from the startup to 10% power operation, and no measurable thermal cycling at the nozzles was found.

The licensee's analysis indicates that neither RWCU reroute nor a new low-flow feedwater controller are necessary because the present drag type valve, having improved flow characteristics with a single element water level control system is rated at 10% of the feedwater flow under both manual and automatic modes.

Based on the above considerations and the presently-observed thermal sleeve leak rate data collected at Vermont Yankee, the staff concludes that an adequate margin of safety against feedwater nozzle crack growth exists. However, the licensee should safeguard against any increase of the leakage flow in the future. The licensee should continue to perform the routine inspections of the feedwater nozzles and spargers in accordance with the intervals specified in Table 2 of NUREG-0619.

Because a Bypass Leak Detection System has been installed and a program of monitoring has been implemented to assure that any leakage is minimal, the staff concludes that the Vermont Yankee plant can operate without rerouting of the RWCU, without removing the clad, and without installing a low-flow controller for the feedwater system. Vermont Yankee should safeguard against any increase of leakage flow in the future.

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