WATTS BAR NUCLEAR PLANT UNITS 1 AND 2
RHR PUMP MOTOR SERVICE FACTOR
NCR SWP 79-W-10
10 CFR 50.55(e)
FINAL REPORT

Description of Deficiency

During preoperational testing at Sequoyah Nuclear Plant, the RHR pump motors were found to exceed their allowable service factor of 1.15. This occurred during certain low head operational modes, such as with one pump discharging to four reactor coolant loops. This problem is related to that of Sequoyah Nuclear Plant NCR CEB 79-4 which partly concerns flow cavitation in certain operational modes caused by excessive pressure drop through the control valves.

The RHR discharge piping system pressure drop is lower than that specified in the Westinghouse design criteria. This comes, in part, from conservative design calculations made using Crane Technical Paper No. 410, which resulted in calculated line pressure drops that are much greater than what is actually being experienced during system testing. The problem was aggravated by the RHRS pump motors having marginal reserve horsepower for maximum service conditions, and by the inability of the RHR throttling valves to throttle under the existing system conditions. Low back pressure in the injection lines allowed cavitation across the valves when throttling. This situation provides the potential for the pump motors to overload from pumping excessive flow rates and for the other problems noted above to occur.

Since the RHRS designs are similar for the Watts Bar and Sequoyah Nuclear Plants, similar corrections will be required at both plants. Also, in the design of any piping system including valves and pumps, the design point characteristics of all components should be kept in balance; a conservatively low pressure drop is not always advantageous.

Safety Implications

Overloading of the pumps could result in pump tripout under some service conditions, one of the worst cases being when the RHR system is furnishing suction to the SIS pumps. This could result in tripout of the RHR pumps and in loss of suction to the SIS pumps, causing damage and/or requiring operator action to restart the system or the redundant train. This would constitute a reduction in the available redundant safeguards provisions described in the plant FSAR.

Corrective Action

Flow restrictions have been added in each RHR pump hot leg and cold leg injection header to provide the pressure drop necessary to prevent pump motor overloading. The restrictions are located downstream of the control valves and the injection flow elements, but upstream of the isolation check valves. These restrictions also are effective in ameliorating the cavitation problem of NCR CEB 79-4. The restriction design was developed by Westinghouse, and the piping system testing will be complete before unit 1 fuel loading. All TVA design project managers have been informed of these problems to prevent recurrence in future plant designs.