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

ENCLOSURE 3

SAFETY EVALUATION OF THE REQUEST TO OPERATE

THE SHOREHAM NUCLEAR POWER STATION AT 25 PERCENT POWER

SAFETY OF PROLONGED OPERATION AT 25 PERCENT POWER

1. INTRODUCTION

The staff concerns that prolonged off-design and reduced power operation may cause accelerated wear or undesirable fatigue damage to certain safety-related equipment from low-flow instability or low-flow induced vibration. Because of this concern, the staff has evaluated these issues as they relate to the reliability of certain safety-related equipment including pumps and valves that may undergo prolonged low-power operation. Based on the staff evaluation, the licensee was requested to determine 1) equipment that may be affected by the low-power operation, 2) the impact of low-power operation on the reliability of these equipment, and 3) compersatory measures to be taken should the reliability of any equipment be affected.

In response to the staff's request dated June 16, 1987, the licensee submitted a letter dated August 4, 1987 addressing the staff's concerns as noted above. An evaluation of the licensee's submittal is presented below.

2. EVALUATION

In an August 4, 1987 submittal, LILCO stated that all plant safety-related systems and equipment were investigated for the effects of continued low-power operation, and the following systems were identified to be power dependent.

- Neutron Monitoring System (NMS)
- Reactor Building Closed-Loop Cooling Water System (RBCWS)
- Reactor Building Service Water System (RBSWS)
- RBSVS/CRAC Chilled Water System (RCCWS)
- Drywell Air Cooling System (DACS)
- Reactor Recirculation System (RRS)
- Main Steam System (MSS)
- Feedwater System (FWS)

The staff has not done a detailed review of all plant systems but a cursory review indicates that LILCO's list of all safety-related systems appears to be complete. The staff also finds that the above eight systems, although power dependent, are not all flow dependent.

The operation of NMS at continued low power induces no significant different operational conditions which could affect the life of NMS operation. With respect to RBSWS, RBCWS, RCCWS and DACS, they are all power dependent, but low-power operation would merely result in a less frequent usage of these systems, and therefore would not adversely affect the systems operation. However, with regard to RRS, MSS and FWS, the staff finds that they are not only power dependent, but also are subjected to prolonged reduced and possibly unfavorable flow operations.

Recent industry experience showed that accelerated wear and failure of certain check valves could occur due to continued undesirable flow operations. Based on this industry experience, the staff requested the licensee to investigate the impact of low-power operation on the reliability of certain equipment in these systems including pumps and valves.

In response to the staff's request, LILCO evaluated the design and operation of the above noted eight power-dependent systems and associated equipment and concluded that they were all designed to operate over the entire range of power operation. In addition, the licensee concluded that no significant adverse impact on equipment reliability would result from continued low-power operation. The staff agrees that all systems and equipment might be designed to operate over the entire power range but disagrees that they would all be designed to operate for a prolonged low-power operation.

Recognizing that feedwater check valves might be the components most vulnerable to reduced flow operation, the licensee investigated the designs of feedwater check valves, and associated piping configuration and flow conditions. One aspect of the licensee's investigation involved the development of minimum flow velocity requirements. A comparison of these minimum flow velocities to the 25 percent power flow velocity showed that the feedwater check valves would only remain partially open. Another aspect of the licensee's evaluation involved identifying potential sources of flow disturbances in the piping system, and the licensee found no sources of significant flow disturbances in the Shoreham feedwater piping system. As a result, the licensee concluded that failure of these check valves was not anticipated since these valves would remain in a stable, partially open position since significant flow disturbances have not been identified.

The staff's review indicates that a partially open check valve presents an unstable flow condition around the valve disc. Regardless how stable the main flow is assumed, the disc position will fluctuate due to pump flow pulsations, causing accelerated wear of the connecting moving parts. Industry data shows that check valve failures can occur after a couple of years of low-flow operation.

The ASME Code, Section XI, requires Inservice Testing (IST) of all safety-related valves. As for check valves, the Code requires that the safety-related position (open or closed) of a check valve be verified every three months. This Code requirement for check valve testing is not sufficient to detect degradation of valve internals. Rather, it is a pass/fail type of test and may not be sufficient in some cases to detect missing valve disks. It is the staff's position that additional inspection has to be instituted to ensure early detection of degradation of valve internals. The licensee committed to perform disassembly and inspection of feedwater system check valve internals, but only proposed to perform it one time at its first refueling outage following the 25 percent power operation. The staff finds the proposed type of inspection acceptable, but only performing it once is inadequate. Based on the available industry experience on check valve failures, the staff concludes that the proposed inspection should be performed at intervals not to exceed two years between inspections.

Excepting feedwater check valves, there has been little failure data reported on other components associated with reduced power operation. It should be noted that the proposed feedwater check valve inspection program and any IST related pump/valve maintenance will provide useful information and indication on how other components in reduced flow systems may behave over extended periods of operation. Pending the results of the proposed inspection and other related activities, inspection and investigation of other flow-dependent components may be necessary. Therefore, detailed recordkeeping of the inspection results and root cause failure analyses need to be incorporated into the procedures of the proposed inspection program. The licensee is required to provide a report to NRC within 90 days of the proposed inspections summarizing activities performed and results of the inspections. Furthermore, should any anomalies be detected during the feedwater check valve inspection or during inservice testing of any other pumps and valves in reduced flow systems, the licensee must provide a report to NRC detailing root cause analysis, compensatory action planned and taken, and investigation results of other flow-dependent systems including RRS and MSS.

In its August 4, 1987 submittal, the licensee did not indicate nor address any concerns regarding pump operation at reduced power. The staff's review of Shoreham pumps indicates that all safety-related pumps are either protected by a mini-flow return line, or not adversely affected by reduced power operation. Therefore, the staff concludes that increased surveillance requirements on pumps are not necessary at this time. However, should any concerns be detected from the valve inspection program, the effect of reduced power operation may be reevaluated.

3. CONCLUSION

Based on the above discussion, the staff finds that the licensee's evaluation of the low-power operation and proposal of inspecting certain components must be augmented. The staff concludes that the licensee's proposal should be modified to include (1) a commitment to disassemble and inspect feedwater check valves every two years, (2) a 90-day reporting requirement following the inspection and (3) extension of the investigation and compensatory action to all affected components, not just limited to feedwater check valves should any anomalies be detected. By committing to the modified proposal and reporting requirements, the licensee would provide adequate assurance for early detection of degradations of affected pumps and valves that might be subjected to prolonged low-power operation.

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