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NUCLEAR REGULATORY COMMISSION
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ENCLOSURE

SUPPLEMENTAL SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

REVISED AUXILIARY FEEDWATER PUMP INSPECTIONS

VIRGINIA ELECTRIC AND POWER COMPANY

SURRY POWER STATION, UNITS 1 AND 2

NORTH ANNA POWER STATION, UNITS 1 AND 2

DOCKET NOS. 50-280, 50-281, 50-338, AND 50-339

INTRODUCTION

Virginia Electric and Power Company (the licensee) responded to NRC Bulletin 88-04, "Potential Safety Related Pump Loss" by letters dated August 8, 1988 for both the Surry Power Station, Units 1 and 2 (Surry 1&2) and the North Anna Power Station, Units 1&2 (NA-1&2). The licensee's responses provided the plans for auxiliary feedwater (AFW) pump disassembly and inspection. In the case of Surry 1&2, the licensee initially committed to inspect one pump during the 1990 and 1991 refueling outages. For NA-1&2, the licensee initially committed to inspect one pump per outage so the three AFW pumps would be inspected at least once every three years. In addition, the licensee committed to install full flow test lines at Surry 1&2. The licensee also committed to consider modifications to the minimum flow recirculation lines at NA-1&2 based on the inspection results. Both Surry 1&2 and NA-1&2 subsequently installed full flow test lines. For both stations, the results of these pump inspections were to determine the future inspection frequency and number of pumps to be inspected. Based on the results of the AFW pump inspections at both stations, the licensee has concluded that no additional inspections are necessary at either station. Future inspections would be based on pump performance and predictive analysis.

EVALUATION

During outages in 1988 and 1989, both stations disassembled and inspected the three AFW pumps on each unit. These initial inspections revealed some pump degradation which was attributed primarily to the many years of pump testing using the minimum flow recirculation lines. Appropriate repairs were made to restore each pump to design condition. Since the initial inspection, the licensee has completed additional inspections at both stations and reported those inspection results in letters dated January 18, 1991 and July 8, 1991 for Surry 1&2 and January 17, 1992 for NA-1&2. Three pumps at Surry 1&2 and

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two pumps at NA-1&2 were inspected with representatives from the pump manufacturer present. The auxiliary feedwater pumps at both stations were supplied by the same manufacturer and are of similar design. No evidence of pump performance degradation was found at either station.

Prior to installation of the full flow test lines, surveillance testing was performed using the minimum flow recirculation lines which provided approximately 5%-10% of design flow. This flow was only adequate for thermal protection. These low flows were found to have contributed significantly to hydraulic instability and the consequent pump damage found during earlier inspections. Providing full flow testing capability for these pumps has eliminated the primary contributor to pump degradation due to hydraulic instability.

At both stations, the AFW pumps are monitored in accordance with ASME Section XI requirements to provide early detection of pump performance problems. Pump differential pressure and vibration are monitored for adverse trends which would be indicative of performance degradation. The licensee's Predictive Analysis Group performs a detailed spectrum analysis of the pump vibration data to identify potential problems which may be occurring before any pump damage can occur. In addition, at both stations, pump lubrication sampling and analysis are performed quarterly with parameters such as wear metals, contaminants, additives, particulate count and viscosity data reviewed and trended.

Through the licensee's Licensed Operator Retraining Program, the licensee's operations personnel have been instructed on how to monitor operating auxiliary feedwater pumps and to minimize periods of extended operation at minimum flow conditions. Operating procedures have also been revised to include a cautionary note to avoid extended periods of pump operation at minimum flow conditions.

In a telephone discussion with the licensee on March 17, 1993, the staff was informed that a fixed orifice, supplied by the pump vendor, is installed in the AFW pump(s) miniflow line to provide a minimum flow of approximately 25 gallons per minute (gpm). The licensee indicated that in essentially all cases where the AFW pumps are automatically activated for safety considerations, the flow through the miniflow lines is irrelevant from a pump performance perspective and has no adverse effect on the AFW pumps. Basically, the only time that warrants operator attention is during testing of the check valve in the miniflow line, which also confirms operability of the fixed orifice, or during other transients such as steam generator overfill where it may be necessary to throttle flow to the steam generators. In these circumstances the operators are provided with appropriate procedures and are trained not to use the miniflow lines for extended periods of time. In the past, both NA-1&2 and Surry 1&2 have operated in the miniflow mode for periods up to 48 hours with no short-term impact on pump performance.

CONCLUSION

Based on the results of the AFW pump inspections to date at NA-1&2 and Surry 1&2, the system modifications which allow full flow testing, and the

comprehensive pump performance monitoring at both stations, the staff concludes that routine AFW pump inspections are no longer necessary at either NA-1&2 or Surry 1&2. In addition, the staff finds that future AFW pump inspections based on performance and predictive analysis are acceptable.

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