

UNITED STATES
NUCLEAR REGULATORY COMMISSION
OFFICE OF NUCLEAR REACTOR REGULATION
WASHINGTON, D.C. 20555

July 24, 1987

NRC INFORMATION NOTICE NO. 87-34: SINGLE FAILURES IN AUXILIARY FEEDWATER SYSTEMS

Addressees:

All holders of an operating license or a construction permit for pressurized water reactor facilities.

Purpose:

This information notice is being provided to alert addressees to potential single failures of auxiliary feedwater pump start and protective pump trip circuitry that could cause partial or complete loss of capability to supply auxiliary feedwater (AFW) in conflict with the design basis. It is expected that recipients will review the information for applicability to their facilities and consider actions, if appropriate, to avoid similar problems. However, suggestions contained in this information notice do not constitute NRC requirements; therefore, no specific action or written response is required.

Description of Circumstances:

On April 30, 1987, the licensee for the Indian Point Unit 2 nuclear power plant identified a potential single failure in a portion of the pump start circuitry that is common to both motor-driven auxiliary feedwater pumps and that could prevent both pumps from starting automatically in the event of either low-low steam generator level or loss of main feedwater. Such a single failure is in conflict with the design basis for the system.

This problem was discovered in the course of a review of the auxiliary feedwater system being conducted by the licensee as followup to a number of operational events that occurred in the fall of 1986.

The pump start circuitry at Indian Point Unit 2 was designed so that the steam generator level and loss of feedwater start signals were routed through contacts of the safety injection inhibit relays. The purpose of these relays is to delay pump starts under safety injection conditions until the safety injection sequencer calls for the pumps to start at the appropriate time. If the contacts of either inhibit relay failed in the open position, neither the low steam generator level nor the loss of feedwater start signals would cause the

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motor-driven pumps to start automatically. Both inhibit relays are normally deenergized and closed. Therefore, for the contact to fail in the open position, a failure in which the relay remains energized or in which the relay sticks open following actuation would have to occur.

Discussion:

When the potential single failure was identified, the licensee entered a 72-hour action statement, as required by the Technical Specification Limiting Conditions for Operation. Within the 72-hour period, the licensee completed a design modification to provide independent inhibit relays for the two motor-driven auxiliary feedwater pumps, which satisfied the single-failure criterion.

Subsequent to the design deficiency determination at Unit 2, a review was conducted at Indian Point Unit 3. The licensee at that unit determined that although the pump start circuitry at Unit 3 was in fact different from that of Unit 2, it also failed to satisfy the single-failure criterion. The motor-driven auxiliary feedwater pump start logic circuitry at Indian Point Unit 3 incorporates a pump start (delay) relay that responds to either a main feedwater pump trip or low-low steam generator level signal. Processing of either signal requires the operability of this relay, which is common to both motor-driven auxiliary feedwater pump start logic circuits. Failure of this relay could similarly prevent both pumps from starting automatically. Unit 3 is currently shutdown for refueling and corrective actions are still being planned.

Previous Similar Occurrence

On March 7, 1985, the licensee for the Salem Generating Station Units 1 and 2 reported (LER 50-272/85-01) to the NRC that the auxiliary feedwater pump (AFP) trip circuitry did not meet the single-failure criterion. The licensee discovered this in an ongoing review of design changes in which the AFP circuitry was modified to provide protection of all three AFPs in the event of a loss of water supply resulting from tornado damage to the auxiliary feedwater storage tank. The licensee's review of this trip circuitry revealed several potential single failures that could stem from a single test switch circuit, a single suction pressure instrument, and a single low suction pressure trip output relay. Failure of any one of these protective features could have resulted in tripping all three AFPs. The licensee immediately took interim corrective actions to eliminate the potential single failure vulnerabilities. Subsequently, the licensee modified the low suction pressure pump trip circuitry to provide the protective feature without the potential for a single failure causing a loss of all AFW.

These conditions serve to highlight the potentially generic aspects of single-failure vulnerabilities in the automatic start and pump protection logic arrangements for auxiliary feedwater pumps.

This information notice requires no specific action or written response. If you have questions about this matter, please contact the Regional Administrator of the appropriate NRC regional office or this office.

Charles E. Rossi
Charles E. Rossi, Director
Division of Operational Events Assessment
Office of Nuclear Reactor Regulation

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Samuel D. MacKay, NRR
(301) 492-8394

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| 87-30 | Cracking of Surge Ring Brackets in Large General Electric Company Electric Motors. | 7/2/87 | All nuclear power reactor facilities holding an OL or CP. |
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| 87-26 | Cracks in Stiffening Rings on 48-Inch Diameter UF ₆ Cylinders. | 6/11/87 | All uranium fuel fabrication and conversion facilities. |

OL = Operating License
CP = Construction Permit

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