SSINS No.: 6835
IN 86-79

UNITED STATES
NUCLEAR REGULATORY COMMISSION
OFFICE OF INSPECTION AND ENFORCEMENT
WASHINGTON, D.C. 20555

September 2, 1986

IE INFORMATION NOTICE NO. 86-79: DEGRADATION OR LOSS OF CHARGING SYSTEMS AT PWR NUCLEAR POWER PLANTS USING SWING-PUMP DESIGNS

Addressees:

All nuclear power reactor facilities holding an operating license or a construction permit.

Purpose:

This notice is provided to alert recipients of a possible degradation or actual loss of primary coolant charging systems when using swing-pump designs (i.e., one of three pump motors can be aligned to receive electrical power from either of two separate electrical buses). It is expected that recipients review this information for applicability and consider actions, as appropriate, to preclude this and similar problems from occurring at their facilities. However, suggestions contained in this notice do not constitute NRC requirements; therefore, no specific action or written response is required.

Description of Circumstances:

Surry Unit 1

Surry Unit 1 has three charging pumps which also serve as high head safety injection pumps. The "A" pump is powered from the "A" bus, the "B" pump is powered from the "B" bus. The "C" pump is a swing pump and may be powered from either bus; however, its normal power supply is from the A bus. On June 26, 1985 Surry Unit 1 was operating at 100% of full power with the A charging pump out of service for maintenance. The C swing charging pump was being powered from the A bus. While in this configuration, the operators racked out the B charging pump motor breaker to perform maintenance on the pump. Subsequently, the normal feeder breaker for the operating C charging pump motor tripped as a result of an electrical interlock. With the A and B pumps out of service and the C charging pump motor tripped, all makeup water (including high head safety injection) and reactor coolant pump seal injection flow were unavailable. The operator immediately racked in the B pump motor breaker, thereby clearing the interlock, and the C charging pump restarted. An electrical jumper was installed around the interlock in the B pump motor breaker cubicle to prevent the breaker for the C charging pump motor from tripping. The breaker for the B pump motor was then racked out.

The charging pump interlocking scheme at Surry Unit 1 is designed such that each of the two essential power source buses provides power to only one charging pump motor at a time. When the B pump feeder breaker was racked out of service, the interlock design assumed that the A pump was being operated from the A bus (although, in fact, it was out of service) and tripped the C pump to prevent it from being powered by the A bus. There is no automatic transfer of the C pump to the B bus; this prevents a postulated fault on the C pump from tripping both buses.

The cause of the event was attributed to inadequate precautions in the procedure to remove the B charging pump from service. The licensee reinstructed operating personnel on the operation of the swing pump design regarding the associated interlocking scheme in use at Surry Unit 1. Labels were attached to the breakers associated with the charging pump motors to provide warning information related to the existing interlocks.

Millstone Unit 2

On June 11, 1985 during routine testing on the Millstone Unit 2 simulator, an apparent design deficiency was identified in interlocking circuitry associated with the B charging pump motor. The B charging pump is the swing pump and, as such, its motor can be aligned to either of two electrical power buses. At Millstone Unit 2 the charging pumps provide makeup water to the primary system during normal plant operating conditions and ensure adequate shutdown margin during accident conditions. The problem identified on the simulator resulted in the B pump being rendered inoperable following a loss of power for the electrical bus opposite to the one to which the B charging pump motor was aligned. Subsequent investigation of the actual plant circuit design by the licensee confirmed that indeed electrical power must be available on both buses before the B charging pump can be started by either automatic or manual means. A modification to the circuit design was immediately implemented to prevent inoperability of the B charging pump under such conditions. A review of other potentially affected circuits at the Millstone plant was undertaken and no similar problems were identified.

Discussion:

The events described above were identified during a systematic NRC study of licensee event reports. These events illustrate how the safety function of the charging systems using swing-pump designs can be degraded or lost as the result of design deficiencies in interlocking circuitry or inadequacies in maintenance procedures. The NRC study of the generic implications surrounding these events did not identify any other similar event or situation. However, the study does raise the concern that degradation or actual loss of charging systems could occur at a time when makeup water to the primary system would be needed, either during normal or accident conditions. The study also concluded that the types of deficiencies identified at Surry Unit 1 and Millstone Unit 2 for swing-pump designs are not likely to be detected by normal design reviews and/or routine testing. It takes a specific set of circumstances or conditions to readily detect the deficiencies in interlock circuitry or maintenance procedures. The likelihood of the occurrence of such circumstances and/or conditions is small. This is evidenced by the fact that Surry Unit 1 and Millstone Unit 2 operated

for more than 10 years before the deficiencies were uncovered. Therefore, these or similar deficiencies may very well exist at other plants which use safety systems with swing-pump designs.

No specific action or written response is required by this information notice. If you have any questions about this matter, please contact the Regional Administrator of the appropriate regional office or this office.

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and Engineering Response
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Attachment: List of Recently Issued IE Information Notices

Attachment 1
IN 86-79
September 2, 1986

LIST OF RECENTLY ISSUED
IE INFORMATION NOTICES

Information Notice No.	Subject	Date of Issue	Issued to
86-78	Scram Solenoid Pilot Valve (SSPV) Rebuild Kit Problems	9/2/86	All BWR facilities holding an OL or CP
86-77	Computer Program Error Report Handling	8/28/86	All power reactor facilities holding an OL or CP and nuclear fuel manufacturing facilities
86-76	Problems Noted In Control Room Emergency Ventilation Systems	8/28/86	All power reactor facilities holding an OL or CP
86-75	Incorrect Maintenance Procedure On Traversing Incore Probe Lines	8/21/86	All power reactor facilities holding an OL or CP
86-74	Reduction Of Reactor Coolant Inventory Because Of Misalignment Of RHR Valves	8/20/86	All BWR facilities holding an OL or CP
86-73	Recent Emergency Diesel Generator Problems	8/20/86	All power reactor facilities holding an OL or CP
86-72	Failure 17-7 PH Stainless Steel Springs In Valcor Valves Due to Hydrogen Embrittlement	8/19/86	All power reactor facilities holding an OL or CP
86-71	Recent Identified Problems With Limitorque Motor Operators	8/19/86	All power reactor facilities holding an OL or CP
86-70	Spurious System Isolation Caused By The Panalarm Model 86 Thermocouple Monitor	8/18/86	All GE BWR facilities holding an OL or CP
86-69	Scram Solenoid Pilot Valve (SSPV) Rebuild Kit Problems	8/18/86	All BWR facilities holding an OL or CP

OL = Operating License
CP = Construction Permit