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UNITED STATES
NUCLEAR REGULATORY COMMISSION
OFFICE OF INSPECTION AND ENFORCEMENT
WASHINGTON, DC 20555

December 19, 1986

IE INFORMATION NOTICE NO. 86-105: POTENTIAL FOR LOSS OF REACTOR TRIP CAPABILITY AT INTERMEDIATE POWER LEVELS

Addressees:

All holders of an operating license or a construction permit for pressurized water reactors (PWR) or boiling water reactors (BWR).

Purpose:

This notice is intended to alert licensees operating Westinghouse reactors of the potential for loss of some reactor trip functions when operating below 10 percent of full power as a result of failure of the P-10 interlock circuitry. It is expected that recipients will review this information for applicability to their reactor facilities and will consider actions, if appropriate, to preclude occurrence of this problem or similar problems. Suggestions contained in this notice do not constitute NRC requirements; therefore, no specific action or written response is required.

Description of Circumstances:

The reactor protection system for Westinghouse reactors includes source, intermediate, and power range channels for monitoring neutron flux during startup, operation at power, and shutdown of the reactor. During startup, trip points at the upper end of the intermediate range channels and at the lower end of the power range channels will automatically shut the reactor down if an unanticipated increase in power of sufficient magnitude occurs. Typically, these trip points on the overlapping intermediate and power range channels are set at 25 percent of full power. So that reactor power can be raised above 25 percent, the P-10 permissive interlock is enabled, typically at 10 percent of full power. Among other things, this interlock, when enabled, permits the operator to manually block the intermediate flux trips. When power is decreased below 10 percent, the P-10 permissive interlock automatically reinstates the intermediate flux trip logic.

Circuitry for the P-10 permissive interlock includes one solid-state bistable switch on each of the four power range channels. During power ascension, when the indicated power level for each power range channel exceeds 10 percent, its associated bistable switch trips. When the second of the four bistable switches trips, the interlock is enabled. After the flux trips at 25 percent are blocked, protection against high neutron flux continues to be provided by the power

range trips that are set typically at 109 percent of full power. When power is decreased below 10 percent, three of the four bistable switches must reset; otherwise, the intermediate flux trips will not be automatically reinstated.

By letters dated February 27 and April 29, 1986, Westinghouse Electric Corporation advised the Office of Inspection and Enforcement that, under certain circumstances, the intermediate trips would not be reinstated when reactor power is decreased below 10 percent. For example, if one power range channel is taken out of service when reactor power is above 10 percent, as is permitted by technical specification, and if the bistable switch for another power range channel should fail such that it does not reset, then the three-out-of-four logic would not be satisfied when reactor power is decreased below 10 percent. Thus, a single failure could prevent reinstatement of the intermediate trips when a power range channel is out of service with reactor power below 10 percent.

Discussion:

The P-10 permissive interlock performs two functions. First, when at least two of the power range channels are above the P-10 set point and their P-10 bistable switches are tripped, the P-10 interlock provides one of the redundant inputs (with P-13) to the P-7 interlock which enables other reactor trips, automatically disables the source range channels and the reactor trip signals that they provide, and permits manual blocking of the trips at the upper end of the intermediate range channels and the lower end of the power range channels. Second, when at least three of the four power range channels are below the P-10 set point and their P-10 bistable switches have reset, the P-10 interlock enables the trips at the upper end of the intermediate range channels and the lower end of the power range channels which were previously disabled and, if P-13 has reset, automatically disables several other reactor trips. Additionally, the P-10 interlock enables the source range channels by connecting high voltage to their detectors, and it enables the reactor trips at the high end of the source range channels when P-6 is reset at the lower end of the intermediate range channels. If P-10 fails, indication in the control room of the flux level from the source range channels would be lost. This is particularly important for plants that depend on this instrumentation to initiate automatic or manual actions to protect the reactor under certain conditions, including flux doubling or high flux which could be indicative of boron dilution. If the P-10 interlock does not function properly when the reactor is below 10 percent of full power, a substantial amount of protection would be lost.

Accident analyses in safety analysis reports which take credit for the intermediate trips are (a) the uncontrolled boron dilution accident, (b) the uncontrolled withdrawal of a control rod bank from subcriticality, (c) the control rod ejection accident, and (d) the excessive feedwater accident from subcritical. Evaluation of the first three of these analyses by Westinghouse has led them to conclude that the margin for safety as defined in the bases for technical specifications might be reduced under certain circumstances for accidents (a) and (b) if the intermediate trip is not available below 10 percent of full power. Westinghouse states that, while fuel failure would not be expected, the departure from nucleate boiling ratio (DNBR) might be lower than the design criterion. For accident (c), Westinghouse indicates that the

margin of safety would be essentially the same with or without the intermediate trip. For accident (d), Westinghouse does not address the impact on margin of safety, but does imply that corrective action would be prudent.

The Westinghouse letter of February 27, 1986, suggested several actions that licensees could consider pending resolution of this problem. After discussion with the NRC staff, Westinghouse submitted a clarifying letter on April 29, 1986. In summary, Westinghouse has recommended to licensees that they monitor the status lights for the P-10 bistable switches and for the P-10 permissive interlocks in both trains of the reactor protection system when power is being reduced below 10 percent. In the event that a licensee cannot confirm proper performance of the P-10 interlock, Westinghouse recommends that the licensee consider either (a) using jumpers as appropriate to enable any lost trips and alarms or (b) completing an orderly shutdown, opening the reactor trip breakers to preclude withdrawal of a control rod bank, and closing valves as necessary to preclude boron dilution and excessive feedwater flow.

It is suggested that licensees with Westinghouse reactors consider informing their reactor operators of this potential problem and consider the need to revise operating procedures to guide operators in diagnosing and correcting the problem in a timely way if it occurs. If corrective actions involve the use of jumpers or lifted leads, IE Information Notice 84-37, "Use of Lifted Leads and Jumpers During Maintenance and Surveillance Testing," provides further suggestions.

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

Edward L. Jordan, Director
Division of Emergency Preparedness
and Engineering Response
Office of Inspection and Enforcement

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Attachment: List of Recently Issued IE Information Notices

LIST OF RECENTLY ISSUED
IE INFORMATION NOTICES

Information Notice No.	Subject	Date of Issue	Issued to
86-104	Unqualified Butt Splice Connectors Identified in Qualified Penetrations	12/16/86	All pressurized and boiling-water reactor facilities holding an OL or CP
86-14 Supplement 1	Overspeed Trips Of AFW, HPCI, And RCIC Turbines	12/17/86	All power reactor facilities holding an OL or CP
86-103	Respirator Coupling Nut Assembly Failures	12/16/86	All power reactor facilities holding an OL or CP and fuel facilities
86-102	Repeated Multiple Failures Of Steam Generator Hydraulic Snubbers Due To Control Valve Sensitivity	12/15/86	All power reactor facilities holding an OL or CP
86-101	Loss Of Decay Heat Removal Due To Loss Of Fluid Levels In Reactor Coolant System	12/12/86	All PWR facilities holding an OL or CP
86-100	Loss Of Offsite Power To Vital Buses At Salem 2	12/12/86	All PWRs or BWRs holding an OL or CP
86-99	Degradation Of Steel Containments	12/8/86	All power reactor facilities holding an OL or CP
86-21 Sup. 1	Recognition Of American Society Of Mechanical Engineers Accreditation Program For N Stamp Holders	12/4/86	All power reactor facilities holding an OL or CP
86-98	Offsite Medical Services	12/2/86	All power reactor facilities holding an OL or CP
86-97	Emergency Communications System	11/28/86	All power reactor facilities holding an OL or CP and fuel facilities

OL = Operating License
CP = Construction Permit

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WASHINGTON, D.C. 20555

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