



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

SAFETY EVALUATION FOR ITEM II.K.3.21
OF NUREG-0737, RESTART OF CORE SPRAY
AND LOW PRESSURE COOLANT-INJECTION

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Requirement as stated in NUREG-0737

The core-spray and low-pressure coolant-injection (LPCI) system flow may be stopped by the operator. These systems will not restart automatically on loss of water level if an initiation signal is still present. The core spray and LPCI system logic should be modified so that these systems will restart, if required, to assure adequate core cooling. Because this design modification affects several core-cooling modes under accident conditions, a preliminary design should be submitted for staff review and approval prior to making the actual modification.

Evaluation

The intent of this requirement was to assure adequate water delivery to the core if an operator should manually terminate LPCI or core spray and subsequently fail to restart a system, if required. The licensee referenced as applicable for the Vermont Yankee Nuclear Power Station, the BWR Owners Group position for Item II.K.3.21. The response of the BWR Owners Group to Section II.K.3.21 is given in a letter report to Darrell G. Eisenhut (NRC) from D. B. Waters (BWR Owners Group), dated December 29, 1980.

The essence of the Owners Group position with respect to BWR's, other than BWR 5's and BWR 6's is that automation of the restart of LPCI and core spray (or low pressure core spray) will result in a net decrease in safety because of the complexity of the logic required.

High drywell pressure and low reactor water level are the key accident-related parameters that govern operation of the BWR emergency core cooling systems (ECCS). The occurrence of either or both of these signals is taken as an indication that a loss of coolant-accident (LOCA) has occurred. This combination provides diversity of initiating signals but the control systems hardware does not discriminate between signals generated by the drywell pressure sensors and those produced by the reactor water level instruments. There are many accident sequences for which one or both of the ECCS initiation signals will persist for long periods of time.

With the present logic, the reactor operators can, at any time, stop any BWR ECCS even if a LOCA signal is present. This provides the plant operators with flexibility for dealing with unforeseen but credible conditions requiring a particular system to be shut down. Examples would be equipment difficulties involving gross seal leakage, breaks in ECCS piping, failed ECCS pump motors and load shedding for other post-LOCA operations. This flexibility would still be needed for the automated system but the automation would increase the complexity of the required logic. With increased complexity there is an attendant reduced system reliability and restricted operating flexibility in dealing with unanticipated events. In this case the increased complexity results in a net decrease in safety.

Another problem in providing automatic restart of LPCI and low pressure core spray exists, in that much of the equipment from the residual heat removal (RHR) system used for the LPCI/ECCS mode is also used for cooling the suppression pool. Cooling the suppression pool becomes necessary because many BWR transient and accident events involve significant release of reactor system energy to the suppression pool which increases the pool temperature and containment pressure. Control of these temperature/pressure conditions is achieved by manually

placing the LPCI/RHR system in the suppression pool cooling mode, and rejecting heat to the ultimate heat sink via the emergency service water system. Any scheme to provide automatic restart of the ECCS system would either have to bypass the LPCI system after it has been assigned to the suppression pool cooling function or automatically realign the equipment to the LPCI mode.

Conclusion.

We conclude that automation of the restart of LPCI and low pressure core spray will result in a net decrease in safety because of the complexity of the logic required.

We concur with the Owners Group that logic modifications to the LPCI and low pressure core spray system are not warranted for this plant.